UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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MEMORANDUM

SUBJECT: Environmental Fate and Effects Division RED Chapter for **Oxamyl** (103801)
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This memo summarizes the attached EFED Environmental Risk Assessment (science chapter) for the Oxamyl Reregistration Eligibility Decision document. The following is an overview of our findings:

Oxamyl is a carbamate insecticide and a cholinesterase inhibitor that is highly toxic to terrestrial organisms. The major uses considered in this risk assessment include cotton, apples, potatoes, tomatoes, other vegetables, and non-bearing fruit trees. Acute toxicity and chronic reproductive effects may occur from the application of oxamyl to foliage or other wildlife food items. This risk is greatly reduced when oxamyl is incorporated into the soil. Oxamyl's susceptibility to degradation, especially in neutral and alkaline environments, reduces the probability of prolonged exposure to the chemical. The chemical is expected to dissipate relatively quickly under many conditions, hydrolyzing rapidly under neutral to alkaline conditions. In acidic soils, oxamyl degraded with half-lives that were typically 2 weeks or less; in acidic water, oxamyl photolyzed rapidly. While oxamyl can reach surface water by spray drift or runoff, it is not likely to persist and is not expected to pose unacceptable risks to aquatic organisms.

Risks to Terrestrial Organisms

- Oxamyl is a known cholinesterase inhibitor in avian and mammalian species. Results of the risk assessment suggest that oxamyl poses acute and chronic risks to avian and mammalian species from unincorporated spray applications. Risks exceeded the LOCs for all use patterns even after just one foliar spray application of $\geq$ 1 lb ai/A of oxamyl.

- Discrepancies between the field data/incident data, which infer lack of bird and mammal mortality, and the risk assessment, which suggests acute and chronic risk to avian and mammalian species, may result from two factors. While oxamyl is highly toxic to these species, both acutely and chronically, it also has a short terrestrial half-life. However, it is possible that the field studies did not capture the full magnitude of impact. As with many field studies and incident data, lack of mortality does not necessarily negate risk to the exposed organisms or imply that mortality is not occurring. Birds and mammals may be exposed and then move off-site, leaving the treatment area to die elsewhere unseen. Chronic population effects may go unseen all together unless years of precise reproduction and population data are collected.

- Acute toxicity and reproductive effects to avian and mammalian species may result from one-time, or short-pulse, exposures to oxamyl shortly after application. Multiple applications may pose even greater hazard. However, Oxamyl dissipates rapidly under most conditions, reducing the probability of prolonged exposure and risk.

- In general, risk to avian and mammalian species may be reduced when soil incorporation methods are used by reducing limiting wildlife access to the compound.

- According to submitted incident data and field studies, risk and adverse effects to beneficial insects and amphibians may occur.

Risks to Aquatic organisms

- No acute or chronic LOCs were exceeded for any modeled use pattern for freshwater or estuarine/marine fish.

- Restricted use and endangered species acute LOCs were exceeded for freshwater invertebrates. Chronic LOC's for freshwater invertebrates were not exceeded for any use pattern. The endangered species LOC was exceeded for the modeled use patterns for estuarine/marine invertebrates.

Risks to Endangered Species

- Acute and chronic risks are possible for avian and mammalian endangered species from most single and multiple applications of oxamyl. The high acute and chronic toxicity of the compound as well as high single application rates, multiple applications and use patterns that do not provide for incorporated applications all contribute and exacerbate the risk. Risks to some aquatic organisms (freshwater and estuarine/marine invertebrates) were evident as well. Results from field studies suggest that endangered/threatened amphibians may also be at risk.

The concerns above are based on the following assessments:

- Oxamyl dissipates in the soil environment by chemical and microbially-influenced degradation and by leaching, with estimated half-lives on the order of several days to several weeks. Degradation is pH-dependent, with oxamyl hydrolyzing rapidly in neutral to alkaline environments, but persisting in acidic conditions.

- Oxamyl has the potential to reach surface and ground water resources. However, the compound is not expected to be persistent in water, and is not expected to accumulate or build up over time. Long term contamination is not expected since the compound degrades fairly rapidly. While the compound can and does leach to ground water, it is not detected frequently or at high concentrations, probably because it is quickly degraded by chemical and biological processes.

- Oxamyl is highly to very highly toxic to birds and mammals on an acute basis. Chronic reproductive effects include reduction in egg production and egg fertility in birds and decreased body weight during lactation in mammals. Honeybees and other beneficial insects may be exposed to oxamyl through its use on tree fruits, vegetable crops, and field crops. Oxamyl is moderately to highly toxic to bees on an acute contact basis.

- Oxamyl shows moderate acute toxicity to freshwater fish and high to moderate toxicity to freshwater aquatic invertebrates. Chronic effects include reduction in larval survival in freshwater fish and increased mortality in aquatic invertebrates. Oxamyl shows moderate acute toxicity to estuarine/marine fish and ranges from slightly to highly toxic to estuarine/marine aquatic invertebrates. No data were submitted to assess chronic effects to either estuarine/marine fish or estuarine/marine aquatic invertebrates. Currently, plant testing is not required for pesticides other than herbicides and fungicides except on a case-by-case basis (e.g., labeling bears phytotoxicity warnings, incident data or literature that demonstrates phytotoxicity).

Data Gaps

Environmental Fate: While a few data gaps exist for environmental fate (aquatic metabolism studies) and ecological toxicity (estuarine/marine fish early life-stage and invertebrate life-cycle studies) data, the Agency is not requesting additional data. Existing data indicate that oxamyl will hydrolyze in neutral to alkaline water and will photolyze rapidly in acidic surface water. Even though the Agency has no studies to indicate the role of microbial processes on oxamyl degradation in water, screening models did not predict environmental concentrations of the parent oxamyl that exceeded levels of concern. Two small-scale prospective ground-water monitoring studies are currently underway in North Carolina (cotton) and Maryland (tomatoes) to better characterize the magnitude and extent of potential oxamyl concentrations in vulnerable ground water sources.

The oxime and dimethyloxamic acid (DMOA) degradates seem to be more mobile and persistent than parent oxamyl, although available environmental fate and toxicity data are too limited to properly assess and characterize the risks from exposure to these metabolites. Limited available data suggest that oxime and DMCF, a degradate that was not detected in the environmental fate studies, may be less toxic than parent oxamyl to mammals.

Eco-toxicity: Oxamyl use in coastal counties may result in exposure to nontarget estuarine/marine organisms. Existing aquatic acute (freshwater and marine) and chronic (freshwater) studies suggest potential chronic effects for estuarine/marine organisms. Environmental fate data indicate that oxamyl will hydrolyze rapidly in the alkaline pHs of estuarine and marine waters (half-life on the order of hours). Therefore, prolonged exposure to oxamyl is not anticipated in these waters. While the absence of these studies result in uncertainties in terms of potential chronic effects to nontarget estuarine/marine organisms, OPP is not asking for these studies because of expected rapid degradation of the compound if it should enter estuarine/marine habitats.

Oxamyl (Vydate-L; EPA #352-372) is listed as a plant growth regulator (apple thinning) and as such, plant testing is required. **Seedling germination/emergence (122-1 a), vegetative vigor (122-1 b) and aquatic plant growth (122-2) testing is required**. Oxamyl has a residual period in plants of approximately 1 to 2 weeks. Plants take oxamyl up through both leaves and roots.

Risk Reduction

EFED believes that a reduction in rate, number of allowable applications and using only soil incorporated application methods may mitigate some risk to avian and mammalian species.

Recommended Label Language

EFED recommends that the following language be included on the appropriate labels.

Statement to minimize the potential for surface water contamination for all end-use products:

This chemical can contaminate surface water through ground spray applications. Under some conditions, it may also have a high potential for runoff into surface water after application. These include poorly draining or wet soils with readily visible slopes toward adjacent surface waters, frequently flooded areas, areas overlaying extremely shallow ground water, areas with in-field canals or ditches that drain to surface water, areas not separated from adjacent surface waters with vegetated filter strips, and areas over-laying tile drainage systems that drain to surface water.

Label statements for toxicity to nontarget organisms:

<u>Manufacturing Use Products</u>

This pesticide is toxic to aquatic organisms and wildlife. Do not discharge effluent containing this product into lakes, streams, ponds, estuaries oceans or other waters unless in accordance with the requirements of a National Pollutant Discharge Elimination System (NPDES) permit and the permitting authority has been notified in writing prior to discharge. Do not discharge effluent containing this product to sewer systems without previously notifying the local sewage treatment plant authority. For guidance contact your State Water Board or Regional Office of the EPA.

End Use Products: Non-granular formulations

This pesticide is toxic to aquatic organisms and extremely toxic to birds and mammals. Cover or disc all spill areas. Birds and mammals feeding in treated areas may be killed. Do not apply directly to water or to areas where surface water is present or to intertidal areas below the mean high-water mark. Drift and runoff may be hazardous to aquatic organisms in neighboring areas. Do not contaminate water when disposing of equipment washwater or rinsate.

Precautionary honeybee label statement

This product is highly toxic to bees exposed to direct treatment or residues on blooming crops or weeds. Do not apply this product or allow it to drift to blooming crops or weeds if bees are visiting the treatment area.

Oxamyl Reregistration Eligibility Document
Environmental Fate and Effects Chapter

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Use Characterization

Oxamyl is an acaricide, insecticide, nematicide, and plant growth regulator used on a variety of terrestrial food, feed, and non-food crops (refer to the Use Profile for details). The active ingredient is applied in liquid formulations by aircraft and ground spray equipment, irrigation (gravity, drip, low pressure, sprinkler), and a variety of soil incorporation equipment. For the environmental risk assessment, uses were selected to portray the extent of risk from oxamyl use, serve as surrogates for other label uses, and bracket the range of uses. The selected uses (Table 1) include the crops with the highest amount of oxamyl use (cotton, apples, tomatoes, potatoes) and the maximum single (carrots and non-bearing fruit trees, soil-applied) and seasonal (potatoes) application rates within the continental United States. Higher label application rates exist for yams in Puerto Rico and ginger in Hawaii. These uses were not included in quantitative risk assessments but are discussed in the risk characterization section.

Table 1: Rates and Usage Information For Oxamyl Uses Evaluated in the Environmental Risk Assessment.

Crop/Application Method	*Max Appl. Rate (lb ai/A)*	*Maximum lbs ai/A/Year*	*Interval (days)*	*Major Crop/Use Areas*
Cotton / aerial, ground boom	1	4	6-8	Mid-south, southeast, TX, AZ, CA
Apples / air blast, aerial	2	2	7	VA, MI, WA
Potatoes / sprinkler, aerial, foliar	4 (soil), 1 (foliar)	9 (6 in northeast)	–	Pacific NW, MI; restricted to foliar use in northeast
Tomatoes / drip, injection (CA), foliar	2	8	7	CA, FL
Carrots or **non-bearing fruit trees** / applied to soil	8	8	–	CA, FL (carrots)

The major use areas in the table are based on information provided by the registrant and collected by BEAD. EFED took these use areas in account in developing model scenarios to estimate environmental concentrations of oxamyl and in characterizing the likely extent of risk.

Exposure Characterization

Environmental Fate Assessment

Oxamyl dissipates in the soil environment by chemical and microbially-influenced degradation and by leaching, with estimated half-lives on the order of several days to several weeks (Table 2). Hydrolysis is pH-dependent, with oxamyl degrading rapidly in neutral to alkaline environments, but persisting in acidic conditions. Photolysis appears to be significant in acidic surface water but not on soil. In the soil, oxamyl metabolizes with a half-life of 2 to 4 weeks under aerobic conditions and less than 1 week under anaerobic conditions. In the field, half of the applied oxamyl dissipated from the surface within less than a week in most studies. The major transformation products identified in the fate studies were oxime and dimethyloxamic acid (DMOA). These degradates seem to be more mobile and persistent than parent oxamyl, although the available environmental fate data are too limited to properly assess and characterize their fate in the environment. Results of a prospective ground-water monitoring study in North Carolina suggest that oxaime may persist for an extended period in ground water and subsurface horizons. Oxamyl has a low affinity for adsorption and is mobile in a variety of soils. Field dissipation studies show that both oxamyl and oxime leach through the soil. Although not tracked, DMOA is also expected to be mobile.

Through acceptable and supplemental environmental fate studies and published scientific literature, a profile of the fate of oxamyl in the environment is complete, except for the following information:

> **Aquatic Metabolism:** Although these studies are not currently required for the uses of oxamyl, the absence of data on aerobic aquatic metabolism gives OPP no means of estimating the contribution of microbially-mediated pathways in aquatic environments. However, hydrolysis studies indicate that oxamyl will hydrolyze rapidly in neutral to alkaline waters and a photolysis study in acidic water suggests that oxamyl will photolyze rapidly in water. These are expected to be the major routes of degradation of oxamyl. In the absence of data, OPP has assumed that aerobic aquatic metabolism is not a major route of transformation for oxamyl in water.

> **Small-Scale Prospective Ground-Water Monitoring Studies:** Oxamyl has characteristics similar to other compounds that are known to leach to ground water. The magnitude and extent to which oxamyl may be found in ground water is not known. Two studies are currently underway in North Carolina (cotton) and Maryland (tomatoes) to answer these questions. This chapter includes a summary of the results to date.

Table 2 summarizes the environmental fate characteristics of oxamyl. An analysis of the significance of the data is presented in this section. Appendix A shows the structures and full chemical names of oxamyl and its major transformation producets. Detailed discussion of the studies that went into this assessment can be found in Appendix B.

Table 2: Summary of Environmental Chemistry and Fate Parameters For Oxamyl (See Text for Analysis)

Parameter		**Value**	**Reference/Comments ***
		Selected Physical/Chemical Parameters	
Water Solubility		2.8×10^5 mg/L (ppm) at 20° C	
Vapor pressure		3.8×10^{-7} mm Hg (25° C)	
Henry's Law Constant		2.38×10^{-7} atm m^3 mol^{-1}	
Octanol/Water Partition		$K_{ow} = 0.33$	
		Persistence	
Hydrolysis $t_{1/2}$	pH 5 pH 7 pH 9	stable (>31 da) 8 da 3 hr	MRID 406065-16 (v)
Photolysis $t_{1/2}$	in water	4-11 da in 3 studies	MRID 406065-15 (v); ACC.# 40494 (s)
	on soil	stable (similar to dark control)	Acc. # 147704 (v)
Soil metabolism	Aerobic	$t_{1/2}$ = 11-27 da in 6 soils mean 16 da; s.d. = 5.4 $x_{upper\ 90\%}$ = 20 da	MRID 428200-01 (v), 413462-01 (s) ACC.# 63012 (v), 40494 (s), 154748 (s)
	Anaerobic	$t_{1/2}$ = 5-<7 da in 4 soils; mean 6 da; s.d. = 0.7; $x_{upper\ 90\%}$ = 7 da	MRID 428200-01 (v), 413462-01 (s) ACC.# 40494 (s), 113366 (s)
Aquatic metabolism	Aerobic	No studies are available	
	Anaerobic	No studies are available	
Major Transformation Products Identified in the Fate Studies: Oxime [methyl-2-(dimethylamino)-N-hydroxy-2-oxoethanimidothioate] Dimethyloxamic acid, DMOA, [(Dimethylamino)oxoacetic acid]			
		Mobility/Adsorption-Desorption	
Batch Equilibrium		K_d 0.02-0.40 in 5 soils K_{oc} 6-12 [1] No adsorption in 3 soils	ACC.# 154748 (s), 40494 (s)
Column Leaching		83-100% in leachate in 6 unaged soil columns 37-67% in leachate in 4 aged soil columns	MRID 406065-14 (v) ACC.# 141395 (v)
		Field Dissipation	
Terrestrial Dissipation		DT_{50}s from 3-19 da; DT_{90}s from 4 to 76 da; oxamyl detected at deepest sample depths	MRID 415732-01/419639-01 (v) ACC.# 40494 (s), 145302 (s), 149231 (s)
Foliar Dissipation		$t_{1/2}$s ~1-5 da on cotton in AZ; ~2-3 da on apple (PA), potato (NJ) foliage; 2-3 days on soil	Willis and McDowell (1987); MRIDs 4226227-01, 423330-01
		Bioaccumulation	
Accumulation in Fish		not expected due to low K_{ow}	

* (v) = acceptable (valid) study that fulfills guideline requirement; (s) = supplemental study

[1] These studies are incomplete because the soils were not fully characterized. However, the weight of evidence indicates that oxamyl has a low affinity to adsorb to soil and is likely to be highly mobile.

Persistence

Chemical Degradation Processes: While stable to hydrolysis in acidic conditions, oxamyl hydrolyzes in neutral and basic solutions, with a half-life decreasing from 8 days at pH 7 to 3 hours at pH 9. In an aqueous photolysis study, oxamyl degraded with a half-life of 7 days in pH 5 buffer solution. A separate photolysis study using distilled water (no pH reported) suggested a concentration-dependent rate of degradation: oxamyl degraded with a half-life of 11 days at a concentration of 1 mg/l and 4 days at a concentration of 1000 mg/l. In contrast, the chemical was stable in the dark controls in these studies. Oxamyl degraded at similar rates in the dark and under artifical light on two soils, suggesting that hydrolysis and/or metabolism are more important degradative pathways than photolysis in soil. Oxime is the dominant non-CO_2 transformation product in the hydrolysis and aqueous photolysis studies, comprising 83 to 93% of the applied radioactivity by the end of the hydrolysis studies (at pH 7 and 9) and up to 75% by the end of the photolysis studies. Although these studies were not conducted long enough to track a pattern of decline, they suggest that oxime may be more persistent to hydrolysis and photolysis than oxamyl.

Microbially-mediated Processes: In aerobic soil metabolism studies on 6 soils (pH values predominantly in the acid to neutral range), oxamyl degraded with a half-life ranging from 11 to 27 days (the half-life ranged from 11 to 17 days on 5 soils). In one study, oxime peaked at 24% of the applied radioactivity after 10 days, DMOA reached 20% after 20 days, and CO_2 comprised 45% of the applied after 51 days. Differences in initial oxamyl concentrations on the same soil (4 vs. 20 mg/kg) did not significantly alter the rate of degradation (half-lifes of 11 and 17 days and DT_{50} values – the amount of time for 50% of the original concentration of oxamyl to degrade – of 20 and 21 days for the 4 and 20 mg/kg levels, respectively). In this study, CO_2 comprised up to 63% of the applied radioactivity after 51 days while neither oxime nor DMOA were detected at levels greater than 4%. A study that measured only the evolution of CO_2 from oxamyl-treated soils found that the rate of metabolism increased as the soil moisture content increased.

The rate of degradation of oxamyl is faster under anaerobic conditions, where the half-life ranged from 5 to 7 days on 4 different soils. In an anaerobic soil metabolism study, oxime peaked at 70% after 20 days of flooding and declined to 57% at the end of the 32-day period while DMOA peaked at 23% at the end of the study. DMOA peaked as high as 74% of the applied radioactivity in other anaerobic aquatic metabolism studies. The same transformation products were found in both the aerobic and the anaerobic studies, suggesting that a process other than true anaerobic degradation was occurring. More rapid degradation under anaerobic conditions may be catalyzed by the presence of dissolved (ferrous) iron (Smelt et al, 1983; Bromilow et al, 1986).

Mobility

A combination of supplemental batch equilibrium and column leaching studies and published literature demonstrate that oxamyl has little or no affinity for adsorption on a variety of soils. Although none of the registrant-submitted studies meet guideline requirements in and of themselves (primarily because of incomplete characterization of the soils), the weight of evidence from these studies indicates that oxamyl will be highly mobile.

Adsorption/Desorption: In a batch equilibrium study with 5 soils, oxamyl had Freundlich adsorption values (K_{ads}) ranging from 0.02 to 0.40 ml/g (mean of 0.12, median of 0.06) and K_{oc} values from 6 to 12 ml/g (mean of 9). The 1/n coefficients were 0.92 to 0.97 on 4 soils and 0.77

on the 5th. When the 1/n coefficient is one, the Freundlich K_{ads} values are equivalent to simple K_d values, which are used in modeling. Because 4 of the 5 values are close to 1 and all five K_{ads} values are similar (and low), the K_{ads} values were used as simple K_d values with no conversions in the water resource modeling. In another batch equilibrium study, oxamyl did not adsorb onto 3 soils. Similar values are reported in published scientific literature, with K_ds of 0.02 to 0.62 ml/g in 9 soils and K_{oc}s of 10 ml/g or less in 8 of the 9 soils (Bilkert and Rao, 1985; Bromilow et al, 1980). No K_d or K_{oc} data is available for oxime or DMOA.

Column Leaching: Soil column studies confirm the mobility of oxamyl. In a study using 4 soils packed in 12-inch-long columns, 89-95% of the unaged parent was collected in the leachate. In a second study with 2 soils in 18-inch-long columns, 83-100% of the unaged parent was collected in the leachate. While aging reduces the mobility of oxamyl residues, significant amounts were still detected in the two column studies. In a 12-inch-long column, 67% of 7-day aged residues and 37% of 18-day aged residues were collected in the leachate, compared to 95% in the unaged residues. Oxime and DMOA were found in both the unaged and aged residue leachate. In the 18-inch-long column studies, 61-63% of the applied oxamyl residues aged for 30 days were recovered in the leachate.

Field Dissipation

Terrestrial Field Dissipation: The amount of time in which half of the applied oxamyl dissipated from the surface layer (DT_{50}) ranged from 3 to 19 days in studies conducted in Florida, California, and Washington (Table 3) but contain a high degree of uncertainty because of study design problems. These dissipation rates, which include a combination of degradation and movement via leaching, are similar in magnitude to those reported in the laboratory studies. When both oxamyl and oxime residues are considered, the combined DT_{50} values range from 4 to 39 days. DMOA was not tracked in the field studies. Leaching, along with metabolism and hydrolysis, appear to be major routes of dissipation in the field.

Table 3: Rates of Dissipation of Oxamyl From Surface Layers and Depths of Leaching Observed in Terrestrial Field Dissipation Studies.

Site/Use	*Application Rate, lb ai/ac*	*Dissipation Rate From the Soil Surface Layer for Oxamyl / Oxamyl + Oxime*		*Lowest Depth of Detection, cm* [2]	*Reference/ Comments* [3]
		DT_{50}, days	*DT_{90}, days*		
FL/Cucumbers	18	3 / 4 [1]	4 / 7 [1]	90 +	415732-01, 419639-01 (v)
CA/Cotton	18	4 / 30	38 / 91	90 +	415732-01, 419639-01 (v)
WA/Cherry Orchard	18	19 / 39	76 / 68	90 +	415732-01, 419639-01 (s)
DE	5.65	4	21	75 +	40494 (s)
NY/Potato	3-4	nd	nd	35-185 +	145302 (s)
CA/Lemon	7-10 @ 1 lb monthly intervals via irrigation	nd	nd	120 +	149231 (s)

[1] Dissipation rates were determined for the parent oxamyl and combined oxamyl and oxime residues, respectively.
[2] A (+) indicates oxamyl was detected at the lowest depth sampled
[3] (v) - acceptable (valid) study that fulfills guideline requirements; (s) - supplemental study

The field dissipation studies confirm the potential for oxamyl to move through the soil. Oxamyl residues reached the lowest sampled depth within several weeks of application in field dissipation studies in a variety of crops and sites (Table 3). In the Long Island, NY, study, oxamyl was detected at concentrations of 5.0-5.4 ug/l in three shallow wells (9-12 feet deep) within 10 feet of a treated potato field in the same season of application, but was not detected in later samples. Though not evaluated in the field studies, DMOA should also be mobile in soil due to its carboxylic acid moiety.

Foliar Dissipation: Field studies conducted in apple orchards in Pennsylvania (MRID 422627-01) and potato fields in New Jersey (MRID 423330-01) measured oxamyl concentrations on vegetation over time. The registrant estimated foliar dissipation half-lives of approximately 2 to 3 days in these studies. However, the range of residue concentrations on the foliage was widely scattered so that these values include a high degree of uncertainty. The reported dissipation time (DT_{50}) for oxamyl on soil in these studies also ranged from 2 to 3 days. Willis and McDowell (1987) summarized two studies on the persistence of dislodgeable oxamyl residues on cotton foliage in Arizona (Buck et al, 1980; Ware et al, 1978). The half-lives reported in these studies were approximately 1 to less than 5 days.

Accumulation: Oxamyl has a low water/octanol partition coefficient (K_{ow} = 0.33) and is not expected to accumulate in fish.

Water Resources Assessment

Chemical characteristics and available monitoring data indicate that oxamyl and it's degradation products have the potential to leach to ground water and to enter surface water via leaching and runoff. Oxamyl is very soluble in water (2.8×10^5 mg/L) and tends not to partition to soil, aquifer solids, or sediment (K_d = 0.02-0.40). Soil column leaching studies also indicate that oxime and DMOA are likely to be mobile as well. These properties indicate that the compound is highly mobile in the environment, and will effect surface and ground water quality.

Once the compound has entered surface water it is not expected to persist, but will degrade by chemical and biological processes. Abiotic degradation by photolysis ($t_{1/2}$ = 4-11 days) and hydrolysis in alkaline ($t_{1/2}$ = 3 hours at pH 9) and neutral ($t_{1/2}$ = 8 days at pH 7) waters result in fairly rapid degradation in aqueous environments. Microbially mediated processes also contribute to fairly rapid degradation of the parent to the oxime and dimethyloxamic acid (DMOA) degradates. Aquatic metabolism core studies are not available; however, soil aerobic and anaerobic metabolism studies ($t_{1/2}$ = 11-27 days and 5-7 days respectively) suggest that the compound is broken down by a variety of metabolic processes.

Oxamyl isn't expected to persist in ground water under most circumstances because of its susceptibility to hydrolysis in neutral to alkaline conditions and its rapid degradation under anaerobic soil conditions. However, oxamyl may persist in ground water that tends to be acidic and is not fully anaerobic. There is some evidence that suggests that reduces iron phases can catalyze oxamyl degradation.

Monitoring studies generally suggest that oxamyl is not a major surface water or ground water contaminant. Low concentrations of the parent and degradate have been found in both surface water and ground water as a result of normal agricultural practices. Concentrations in surface water above 1.0 µg/L are generally not observed. Concentrations in ground water are also generally low and the compound is not detected in most monitoring studies. Concentrations as high as 395 µg/L have been detected in one case but generally where the compound is found in ground water it is detected at below 1 µg/L. The oxime degradate is slightly more stable, and will persist longer in ground water and probably in surface water systems. However, only limited monitoring data exist for this compound.

Drinking Water Exposure Assessment

Based on chemical properties, existing monitoring data, and computer simulation, estimates of oxamyl contamination of drinking water supplies resulting from normal agricultural practices have been determined. For drinking water originating in surface water bodies an acute concentration of 1 µg/L should be used to evaluate risk to human health. This value is slightly higher than concentrations reported in monitoring studies but significantly lower than PRZM/EXAMS simulation results. Because of the transient nature of the compound in the environment, concentrations at levels predicted by modeling (30 µg/L) may occur but will generally not persist. Without specifically targeted monitoring data it is not possible to verify peak environmental concentrations. A value of 1 µg/L represents the upper bound concentration where oxamyl was detected in surface water, and is indicative of the peak concentrations that can be expected in drinking water. For chronic health risk evaluation 0.3 µg/L should be used. This value is based on the 1-in-10-year average annual concentration calculated using PRZM/EXAMS, and is in accordance with observed in monitoring data.

For drinking water derived from ground water an acute value of 4.0 µg/L may be used based on maximum values observed in targeted prospective ground water monitoring studies. Although higher ground water concentrations have been reported in non-targeted monitoring studies, such high concentrations are not typical and probably represent extremely vulnerable areas. For evaluating chronic exposure, a value of 1 µg/L should be used. This is a fairly conservative value based on typical concentrations observed in PGW and monitoring studies where the parent compound was detected. The oxime degradate appears to be more persistent in ground water and a chronic value for this degradate should be 3 µg/L based on observed concentrations in PGW studies.

Ground Water Resources

Oxamyl and it's degradation products will leach to ground water under normal agricultural practices. In highly vulnerable areas, ground water concentrations as high as several hundred µg/L may occur. In more typical, though still vulnerable areas, concentrations may be up to 4.0 µg/L based on monitoring data. However, the compound is not expected to be persistent in water and such high concentrations should not persist due to chemical and biochemical degradation. The compound is not expected to accumulate or build up over time. Long term contamination is not expected since the compound degrades fairly rapidly. The degradation products oxime and dimethyloxamic acid are believed to be more persistent then the parent compound.

Non-targeted Ground Water Monitoring Data: Available evidence from valid scientific studies submitted to EPA show oxamyl has the potential to leach to ground water. As a result of normal agricultural use, detections of oxamyl residues in ground water wells have been reported in NY, NJ, RI, and MA, with levels as high as 395 µg/L in ground water (Jacoby et al, 1992). EFED concluded that submission by the registrant of a review of existing monitoring data for oxamyl was inadequate to evaluate oxamyl potential to leach to ground water in its use area, and could not be used to meet any data requirements (EFGWB review 90-0477, dated 9/17/91).

In the USGS NAWQA studies, oxamyl was not detected in ground water samples above the detection limit (0.018 µg/L) in any of the 3144 samples analyzed. Figure 1 shows the NAQWA sampling areas and oxamyl use areas. There appears to be reasonable overlap between sampling locations and use areas.

In the U.S. EPA Pesticides in Groundwater Database (EPA 1990, 1992), oxamyl was detected at concentrations ranging from 0.01 to 395 µg/L in 907 of 23,305 well water samples collected between 1971 and 1991 in 10 states (Jacoby *et al.*, 1992). The majority of detections were in Suffolk County (Long Island), New York, which had 894 detections in 20,955 samples with 3 detections above 2 µg/L. Only three of the 894 wells sampled in the county had any detections above 70 µg/L, and the maximum concentration reported was 395 µg/L. Five detections ranging from 1.0-2.0 µg/L were reported from 757 samples in RI. One detection at 1.4 µg/L was reported from NJ out of 90 well samples. One detection at 0.1 µg/L was reported out of 138 samples in MA.

Oxamyl was detected at concentrations of 5.0 to 5.4 µg/L in three shallow wells (9 to 12 feet deep) installed within 10 feet of a potato field on Long Island, NY. The detections occurred on July 24, 1981, after seasonal applications of 6 and 9 lb ai/acre in 1980 and 1981. No oxamyl residues were detected in the wells (limit of detection of <5 µg/L) in subsequent sampling between August and December, 1981. No oxamyl residues were detected in 8 other existing wells located within 30 to 400 feet of potato fields treated at yearly rates of 3 to 11 lb ai/acre (Acc. No. 96623).

In smaller-scale, non-targeted monitoring studies in the New Jersey coastal plain (Louis and Vowinkel, 1989), North Carolina (Wade *et al.* 1997), and Mississippi (Mississippi Department of Environmental Quality, 1995), oxamyl was not detected in ground water or was detected very infrequently at low levels. While these and other studies do not show major ground water contamination, they are not designed specifically to monitor oxamyl in high use areas. This suggests that care must be takes in evaluating these monitoring results.

Even though only limited monitoring data for oxamyl in ground water in documented oxamyl use areas is available, the data do support a conclusion that oxamyl is at high risk to contaminate vulnerable ground water. When average soil persistence and mobility values are used to estimate relative leaching potential (Gustafson, 1989), oxamyl appears likely to leach to ground water. Compared to pesticides with extensive ground-water monitoring and detection, oxamyl has a leaching potential in the range of the most frequent ground-water contaminants. The actual impact of oxamyl on ground water may be more limited because of its more limited use pattern and its relatively limited persistence. While the compound can and does leach to ground water it is not detected frequently or at high concentrations, probably because it is degraded by chemical and biological processes. It is suggestive, though, that oxamyl continued to be detected at high concentrations (ca. 25 µg/L) in ground water of Suffolk County four years after its use was canceled in that county (EFGWB review dated 9/17/91).

Prospective Groundwater Monitoring Studies: In order to evaluate the potential impact of oxamyl use on ground water, and to determine how persistent oxamyl and its degradates will be in subsurface environments, EPA requested that Small Scale Prospective Groundwater (PGW) Monitoring Studies be conducted. In an on-going PGW study in North Carolina , parent oxamyl was detected in ground water in concentrations up to about 4 µg/L (MRID 447483-01). Generally the concentration was below 1 µg/L. The oxime degradate was detected at concentrations up to 4.5 µg/L and concentrations of 1-2 µg/L were common for several hundred days. The degradate appeared to be significantly more persistent than the parent.

Modeling: Tier I modeling using SCI-GROW gives a groundwater EEC of 4.5 µg/L. (Appendix C). This is in accordance with groundwater concentrations observed in monitoring studies. SCI-GROW provides a groundwater screening exposure value for use in determining the potential risk to human health from drinking groundwater contaminated with pesticides. SCIGROW estimates typical groundwater concentrations if the pesticide is used at the maximum allowable rate in areas where groundwater is vulnerable to contamination. Actual concentrations observed in groundwater may be higher or lower then those derived using SCIGROW, and actual monitoring data should be used to estimate environmental concentrations when possible.

Surface Water Resources

Oxamyl may pose a limited acute risk to organisms living in water bodies that receive discharge. However, because of the relatively rapid degradation, long-term exposure and chronic risk are limited. Oxamyl may persist in acidic soils where light penetration is limited. Oxamyl and it's degradation products have the potential to contaminate drinking water supplies via runoff and drift from spray application. Modeling results suggest that under normal use at the maximum application rates, surface water concentrations may be as high as 30 µg/L. Under most uses surface water concentrations should be lower and fairly rapid degradation will result in limited exposure over time. In seawater and estuarine waters the rapid hydrolysis rate at alkaline pH suggests that oxamyl will degrade with a half-life of several hours and will not present significant chronic risk unless the pesticide is applied frequently.

Modeling: PRZM/EXAMS modeling was used to estimate surface water concentrations (EEC) values for oxamyl resulting from use on apples, carrots and cotton. Input parameters for each PRZM simulation, along with the input files, and descriptions of the scenarios modeled for oxamyl can be found in Appendix C. Soil, cropping and management inputs to PRZM were obtained from local agricultural personal or selected by the PIC (PRZM Input Collator) data base. EXAMS environment inputs are taken from the Georgia pond scenario. Table 4 shows the calculated EEC values for each scenario.

Table 4. Estimated environmental concentrations (drinking water) for Oxamyl on apples (NY), carrots (MI) and cotton (MS) calculated using PRZM/EXAMS.

Crop	1 in 10 Year Maximum Surface Concentration	1 in 10 year Average Surface Concentration Values
Apples	30.8 µg/L	0.28 µg/L
Carrots	24.9 µg/L	0.08 µg/L
Cotton	28.3 µg/L	0.26 µg/L

Non-targeted Surface Water Monitoring Data: Oxamyl is generally not found at high concentrations in surface water monitoring samples. In the U.S.G.S. National Water Quality Assessment (NAWQA) study, oxamyl was detected in surface water in only one sample out of the approximately 5200 for which it was analyzed. The reported concentration value was 0.07 µg/L in a sample from the Willamette Basin, OR. The analytical detection level for the NAWQA data was typically reported as 0.018 with average recovery efficiency of 56 %. The STORET database has 14 reported detections of oxamyl in surface water with concentrations ranging from 0.07 to 0.7 µg/L and a mean of 0.23 µg/L. Ten of the reported detections were from a single station in Whatcom County, CA. One detection was reported in stations in each of the following counties: Franklin (MO), Greene (TN), Caledonia (CA), and Yakima (WA). These values may be representative of environmental concentrations in vulnerable areas. However, these values are not from targeted studies. Because oxamyl is expected to degrade fairly rapidly, the likelihood of grab samples capturing actual peak concentrations is remote.

Ecological Effects Toxicity Assessment

Toxicity testing reported in this section does not represent all species of bird, mammal, or aquatic organisms. Only two **surrogate species** for both freshwater fish and birds are used to represent all freshwater fish (2000+) and bird (680+) species in the United States. For mammals, acute toxicity studies are usually limited to the Norway rat or the house mouse. Estuarine/marine testing is usually limited to a crustacean, a mollusk, and a fish. Neither reptiles nor amphibians are tested. The assessment of risk or hazard makes the assumption that avian and reptilian toxicity are similar. The same assumption is used for fish and amphibians. Generally, the most toxic endpoints for the technical grade active ingredient (TGAI) are used in the assessment to represent each group of organism.

Based on ecological effects data, the toxicity endpoints used in the assessment of oxamyl can be characterized as follows:

- Avian acute oral: Very highly toxic (LD_{50}=3.16 mg/kg of body weight)
- Avian acute dietary: Highly toxic (LC_{50}=340 mg/kg of dry weight of food)
- Avian chronic (reproduction): Reduction in egg production and fertility in the mallard duck (NOAEC=10 mg/kg of dry weight of food)
- Mammalian acute oral: Very highly toxic (LD_{50}=2.5 mg/kg of body weight)
- Mammalian chronic (reproduction): Decreased body weight during lactation in the rat (NOAEL=25 mg/kg of dry weight of food)
- Honey bee acute: Highly toxic (LD_{50}=0.31 ug/bee)
- Fish (freshwater) acute: Moderately toxic (LC_{50}=4.2 mg/l)
- Fish (freshwater) chronic: Reduced larval survival (NOAEC>0.5 mg/l)
- Fish (estuarine) acute: Moderately toxic (LC_{50}=2.6 mg/l)
- Fish (estuarine) chronic: No data
- Invertebrate (freshwater) acute: Highly toxic (LC_{50}=0.18 mg/l)
- Invertebrate (freshwater) chronic: Increased mortality (NOAEC=1.0 mg/l)
- Invertebrate (estuarine) acute: Highly toxic (LC_{50}/EC_{50}=0.40 mg/l)
- Invertebrate (estuarine) chronic: No data
- Terrestrial and aquatic plants: No data

The NOAEC is greater than the LC_{50} for freshwater invertebrates because the most toxic endpoints are based on different test species. A complete listing of these and other toxicity studies for oxamyl (including formulated product testing) can be found in Appendix D. All ecological toxicity data requirements for oxamyl have been fulfilled through core and supplemental studies and published scientific literature with the exception of:

Estuarine/Marine Fish Early Life-Stage Toxicity Study (72-4) and Invertebrate Life-

Cycle Toxicity Study (72-4) – Oxamyl use in coastal counties may result in exposure to nontarget estuarine/marine organisms. Existing aquatic acute (freshwater and marine) and chronic (freshwater) studies suggest potential chronic effects for estuarine/ marine organisms. Environmental fate data indicate that oxamyl will hydrolyze rapidly in the alkaline pHs of estuarine and marine waters (half-life on the order of hours). Therefore, prolonged exposure to oxamyl is not anticipated in these waters. While the absence of these studies results in uncertainties in terms of potential chronic effects on nontarget estuarine/marine organisms, OPP is not asking for this study data because of expected rapid degradation.

Oxamyl (Vydate-L; EPA #352-372) is listed as a plant growth regulator and as such, plant testing is required. **Seedling germination/emergence (122-1 a), vegetative vigor (122-1 b) and aquatic plant growth (122-2) testing is required**. Oxamyl has a residual period in plants of approximately 1 to 2 weeks. Plants take oxamyl up through both leaves and roots (Kidd and James 1991).

Toxicity to Non-Target Terrestrial Animals

Oxamyl is highly to very highly toxic to birds and mammals on an acute basis. Chronic reproductive effects include reduction in egg production and egg fertility in birds and decreased body weight during lactation in mammals.

Avian Species (Acute Oral, Subacute Dietary and Reproduction): In an acute oral toxicity study conducted on mallard ducks, the LD_{50} for the technical product is <10 mg/kg of body weight. Although toxicity studies on the formulated product were not required, the LD_{50}s range from 11 to 39 mg/kg for the 24% liquid oxamyl formulation. The results indicate that oxamyl is very highly toxic to birds. Subacute dietary toxicity studies conducted on bobwhite quail and mallard duck indicate that oxamyl is moderately to highly toxic, with an LC_{50} of 340 to 766 mg/kg of dry weight of food, respectively, for the technical grade active ingredient. Avian reproduction studies in the mallard duck indicate that egg production and egg fertility are significantly reduced at a Lowest Observable Adverse Effect Concentration (LOAEC) of 50 mg/kg of dry weight of food. The No Observable Adverse Effect Concentration (NOAEC) was 10 mg/kg of dry weight of food. No adverse reproductive effects were exhibited at either 10 or 50 mg/kg of dry weight of food in the diet of bobwhite quail.

Mammalian Species (Acute Oral and Reproduction)**:** In toxicity studies conducted on laboratory rats for OPP's Health Effects Division (HED), oxamyl is very highly toxic to small mammals on an acute oral basis (LD_{50} of 2.5 mg/kg of body weight for females and 3.1 mg/kg for males). Results from a chronic reproduction study indicate reproductive toxicity at a LOAEL of 75 mg/kg of dry weight of food (NOAEL of 25 mg/kg) with decreased body weight during lactation being the endpoint affected. Results of a one-generation reproduction study with the 1-Cyano-N,N-dimethylformamide (DMCF) metabolite indicated significantly decreased weanling weights at a LOAEL of 450 mg/kg of dry weight of food (NOAEL of 150 mg/kg). However, DMCF fed rats did exhibit a decreased fertility index (67%) at 150 mg/kg while all other indices were 87 to 100% and weanling weights were significantly lower in rats fed 450 mg/kg.

Insects (Acute contact and dietary): Oxamyl is moderately to highly toxic to bees on an acute contact basis (LD_{50} ranged from 0.3 to 10.3 µg/bee). Results of a residue on foliage study (MRID 409943-01) indicate that residues of Vydate L, applied at 1.0 lb ai/acre, may remain toxic to bees for as long as 6 days after treatment. Houx et al. (1997) reported a 96 hr EC_{50} of 23.6 mg/L for the springtail *(Folsomia candida)*.

Two studies (MRIDs 449381-01 and 449381-02) were submitted to evaluate the effects of Oxamyl 10L on the predatory mite (*Typhlodromus pyri*) and the aphid parasitoid wasp (*Aphidius rhopalosiphi*), both being beneficial insects. Both studies are classified as supplemental as neither were required, neither were guideline studies and the 10L formulation is not registered in the U.S.A. Nevertheless, both studies reported 48 hour LC50s of 0.03g ai ha^{-1} (for the wasp) and 0.6g ai ha-1 (for the mite). Neither study resulted in effects on fecundity at the reported exposure rates when compared to controls.

Toxicity to Non-target Aquatic Animals

Freshwater Organisms

Oxamyl shows moderate acute toxicity to freshwater fish and high to moderate toxicity to freshwater aquatic invertebrates. Chronic effects include reduction in larval survival in freshwater fish and increased mortality in aquatic invertebrates.

***Freshwater fish**:* In acute toxicity studies conducted on coldwater (rainbow trout) and warmwater (bluegill sunfish, catfish, goldfish) species, the 96-hour LC_{50} values for both the technical grade material and formulated product ranged from 3.7 to 27.5 mg/l, suggesting that oxamyl will be slightly to moderately toxic to freshwater fish on an acute basis. Early life-stage toxicity tests conducted on rainbow trout and fathead minnow show that oxamyl significantly affected larval survival at concentrations greater than or equal to 0.5 to 1.0 mg/l.

***Freshwater invertebrates**:* Acute toxicity studies conducted on waterflea (*Daphnia magna*) and midge (*Chironomus plumosus)* suggest that both the active ingredient and the formulated end product of oxamyl is moderately to highly toxic to aquatic invertebrates on an acute basis. The 48-hour LC_{50} or EC_{50} values ranged from 0.2 to 5.7 mg/l in 7 studies (3 on the technical grade active ingredient and 4 on the formulated end product). A life-cycle test conducted with the active ingredient (97% ai) on water fleas (*Daphnia magna*) found a 21-day NOAEC of 1.0 mg/l and a LOAEC of 4.2 mg/l. Increased mortality was the affected endpoint in the study.

Estuarine/Marine Organisms

Oxamyl shows moderate acute toxicity to estuarine/marine fish and ranges from slightly to highly toxic to estuarine/marine aquatic invertebrates. No data were submitted to assess chronic effects to either estuarine/marine fish or estuarine/marine aquatic invertebrates. As noted earlier, OPP is not requesting chronic effect studies for estuarine/marine organisms because oxamyl hydrolyzes rapidly (half-life of hours) in the alkaline estuarine/marine waters.

***Estuarine/Marine fish**:* Testing on the preferred species, sheepshead minnow *(Cyprinodon variegatus),* resulted in a 96-hour LC_{50} of 2.6 mg/l, which is considered to be moderately toxic on an acute basis.

***Estuarine/Marine invertebrates**:* Acute toxicity testing on estuarine/marine invertebrates with the formulated product resulted in 96-hour LC_{50}/EC_{50} values ranging from 0.40 mg/l for eastern oyster to 23.0 mg/l on fiddler crab, values which fall into the slightly to highly toxic acute classes for estuarine/marine invertebrates.

Toxicity to Non-target Plants

Currently, plant testing is not required for pesticides other than herbicides and fungicides except on a case-by-case basis (e.g., labeling bears phytotoxicity warnings, incident data or literature that demonstrates phytotoxicity). However, oxamyl (Vydate-L; EPA #352-372) is listed as a plant growth regulator and as such, plant testing is required. Oxamyl has a residual period in plants of approximately 1 to 2 weeks. Plants take oxamyl up through both leaves and roots.

Ecological Incident Data

An incident (#I000799-003; 5/6/91) in North Carolina was attributed to probable misuse (foul play was suspected) in which oxamyl-laced corn was put in a pasture where ducks were fed. Oxamyl was detected at 8,659 ppm in the laced corn. Ducks, as well as hundreds of fish in a pond, died. Other pesticides were used in the incident area and rainy conditions may have resulted in runoff, contributing to the fish kills.

Oxamyl may be responsible for honeybee kill incidents (I005855-001;1/1/95) reported in a summary of American beekeepers in 22 States for 1995-96. No further information was provided.

The number of documented kills in EPA's Ecological Incident Information System is believed to be a small fraction of total mortality caused by pesticides. Mortality incidents must be seen, reported, investigated, and submitted to EPA to be recorded in the database. Incidents may not be noted because the carcasses decayed in the field, were removed by scavengers, or were in out-of-the-way or hard-to-see locations. Poisoned birds may fly off-site to less conspicuous areas before dying. An incident may not be reported to appropriate authorities capable of investigating it because the finder may not be aware of the importance of reporting incidents, may not know who to call, or may be hesitant to call because of lack of time or desire or because the kill occurred on their property. Limited resources may hamper investigations or preclude a confirmatory analysis of tissues for possible pesticide residues. If kills are not reported and investigated promptly, tissues and residues may deteriorate quickly, reducing the chance of documenting the cause. State submission of incident reports to EPA is voluntary and limited resources may reduce the number of incident reports that are sent to EPA.

Environmental Risk Assessment

Risk assessment of a pesticide's ecological effects integrates the results of exposure and toxicity data to evaluate the likelihood of adverse ecological effects on a non-target species. The means of integrating these exposure factors is the risk quotient (RQ) method. Risk quotients are calculated by dividing estimated environmental concentrations (EECs) of the pesticide by acute and chronic toxicity values. EECs are based on the maximum application rates for that pesticide. The uses and application rates used in the risk assessment can be found in Table 1.

Risk quotients are then compared to the Agency's levels of concern (LOCs). These LOCs are used to analyze potential risk to non-target organisms and the need to consider regulatory action. The criteria are used to indicate when a pesticide used as directed has the potential to cause adverse effects on non-target organisms. LOCs currently address the following risk presumption categories: (1) acute high: high potential for acute risk for all nontarget organisms which may warrant regulatory action in addition to restricted use classification; (2) acute restricted use: potential for acute risk for all nontarget organisms, but may be mitigated through restricted use classification; (3) acute endangered species: endangered species may be adversely affected by use; and (4) chronic risk: potential for chronic risk may warrant regulatory action. Currently, the Agency does not perform assessments for chronic risk to plants, acute or chronic risks to non-target insects, or chronic risk from granular/bait formulations to birds or mammals.

In addition, the Agency considers any incident data that is submitted concerning adverse effects on non-target species.

Risk to Nontarget Terrestrial Animals

Spray Applications to Foliage

The estimated environmental concentration (EEC) values used for foliar terrestrial exposure are derived from the Kenega nomograph, as modified by Fletcher et al. (1994), based on a large set of actual field residue data. The upper limit values from the nomograph represent the 95th percentile of residue values from actual field measurements (Hoerger and Kenega, 1972). The Fletcher et al. (1994) modifications to the Kenaga nomograph are based on measured field residues from 249 published research papers, including information on 118 species of plants, 121 pesticides, and 17 chemical classes. These modifications represent the 95th percentile of the expanded data set. Risk quotients are based on the most sensitive LC_{50} and NOAEC for birds (in this instance, bobwhite quail) and the derived LC_{50} for mammals (based on acute LD50 lab rat studies). EFED uses the FATE model for multiple applications, incorporating the appropriate dissipation half-life to generate EECs. In the case of oxamyl, a foliar dissipation half-life of 5 days, based on published literature, was used. For single application EECs, day zero maximum Fletcher residue values are used (lbs ai/A x 240, 110, 135, and 15 ppm).

Avian Acute and Chronic Risk: Table 5 provides avian acute and chronic risk quotients from exposure to both single and multiple applications of nongranular products containing oxamyl. Single broadcast applications of nongranular products exceeds avian acute high, restricted use, and endangered species levels of concern on most food items. All avian chronic levels of concern for a single broadcast application of nongranular products are exceeded for all uses $\geq$1 lb ai/A for all food groups.

Table 5: Avian Acute and Chronic Risk Quotients for Broadcast Spray Applications of Oxamyl to Foliage, Based on a Bobwhite Quail LC_{50} of 340 mg/kg dry wt of food and NOAEC of 10 mg/kg dry wt of food in the mallard duck.

Use/App. Method	Rate (lbs ai/A) x No. Apps.	Food Items	Max/Ave EEC (mg/kg) [1]	Acute RQ (Max EEC/LC_{50})	Chronic RQ (Max & Ave EEC/ NOAEC)
		Single Application			
Cotton / aerial	1lb/A (1 application)	Short grass	240/85	**0.71**	**24.0/8.5**
		Tall grass	110/36	0.32	**11.0/3.6**
		Broadleaf plants/Insects	135/45	0.40	**13.5/4.5**
		Seeds	15/7	0.04	**1.5**/0.7
Apples / air blast	2 lb/A (1 application)	Short grass	480/170	**1.41**	**48.0/17.0**
		Tall grass	220/72	**0.65**	**22.0/7.2**

Table 5: Avian Acute and Chronic Risk Quotients for Broadcast Spray Applications of Oxamyl to Foliage, Based on a Bobwhite Quail LC_{50} of 340 mg/kg dry wt of food and NOAEC of 10 mg/kg dry wt of food in the mallard duck.

Use/App. Method	Rate (Ibs ai/A) x No. Apps.	Food Items	Max/Ave EEC (mg/kg) [1]	Acute RQ (Max EEC/LC_{50})	Chronic RQ (Max & Ave EEC/ NOAEC)
		Broadleaf plants/Insects	270/90	**0.79**	**27.0/9.0**
		Seeds	30/14	0.09	**3.0/1.4**
Carrots / broadcast spray	8 lb/A (1 application)	Short grass	1920/680	**5.65**	**192.0/68.0**
		Tall grass	880/288	**2.60**	**88.0/28.8**
		Broadleaf plants/Insects	1080/360	**3.18**	**108.0/36.0**
		Seeds	120/56	0.35	**12.0/5.6**
Multiple Applications					
Cotton / aerial	1lb/A x 4 (6-da interval) 4 lb/A total	Short grass	410/145[2]	**1.21**	**41.0/14.5**
		Tall grass	188/62	**0.60**	**18.8/6.2**
		Broadleaf plants/Insects	230/77	**0.70**	**23.0/7.7**
		Seeds	26/12	0.08	**2.6/1.2**
Tomatoes / foliar spray	2 lb/A x 4 (7-da interval) 8 lb/A total	Short grass	757/268	**2.22**	**75.7/26.8**
		Tall grass	347/114	**1.00**	**34.7/11.4**
		Broadleaf plants/Insects	426/142	**1.30**	**42.6/14.2**
		Seeds	47/22	0.14	**4.7/2.2**
Potatoes / foliar spray	1 lb/A x 6 (6-da interval) 6 lb/A total	Short grass	422/150	**1.20**	**42.2/15.0**
		Tall grass	194/63	**0.60**	**19.4/6.3**
		Broadleaf plants/Insects	237/79	**0.70**	**23.7/7.9**
		Seeds	26/12	0.08	**2.6/1.2**
Levels of Comparison					
Endangered species may be affected (acute risk)				$\geq$ 0.1	
Acute risk may be mitigated through restricted use, in addition to endangered species risk				$\geq$ 0.2	
High acute risk, including endangered species				**$\geq$ 0.5**	
Chronic risk, including endangered species					**$\geq$ 1**

[1] EECs are based on Hoerger and Kenega (1972), modified by Fletcher et al (1994).
[2] For multiple applications, EFED uses EECs based on Hoerger and Kenega (1972) and Fletcher et al (1994), with first-order dissipation from foliage between applications. A foliar dissipation half-life of 5 days, based on published data, was used.

The residues expected on avian food items after multiple applications of nongranular oxamyl products are based on the highest residue concentrations after the last application (Fletcher, 1994), with first-order foliar dissipation half-life values of 5 days between applications. The results suggest that avian acute high, restricted use and endangered species levels of concern are exceeded for all use patterns and food items other than seeds, which only exceeded restricted use and endangered species LOCs for tomato and carrot use patterns and only the endangered species LOC for potato and cotton use patterns. Chronic LOC's were exceeded for all use patterns for all food items using maximum and average EECs to calculate RQs other than for seeds for the average single application cotton use.

Mammalian Acute and Chronic Risk: To assess acute risk to mammals from the use of foliar spray products, an estimated dietary endpoint value calculated from the LD_{50} value is used. The EEC is then divided by this calculated dietary value to determine mammalian RQ's. Estimating the potential for adverse effects to wild mammals is based upon EFED's draft 1995 SOP of mammalian risk assessments and methods used by Hoerger and Kenaga (1972) as modified by Fletcher et al. (1994). The concentration of oxamyl in the diet that is expected to be acutely lethal to 50% of the test population (LC_{50}) is determined by dividing the LD_{50} value (usually a rat LD_{50}) by the percentage, expressed as a decimal, of body weight consumed. A risk quotient is then determined by dividing the EEC by the derived LC_{50} value. Risk quotients are calculated for three separate weight classes of mammals (15, 35, and 1000 g), each presumed to consume four different kinds of food (grass, forage, insects, and seeds).

Table 6 summarizes the mammalian acute and chronic risk quotients for broadcast applications of nongranular products based on the rat toxicity data.

Table 6: Mammalian (Rat) Acute and Chronic Risk Quotients for Broadcast Spray Applications of Oxamyl to Foliage, Based on a rat LD_{50} of 2.5 mg/kg of body weight (calculated dietary endpoint of 50 mg/kg) and NOAEC of 25 mg/kg in the diet.

Use/App. Method	Rate (Ibs ai/A) x No. Apps.	Food Items	Max/Ave EEC (mg/kg) [1]	Acute RQ (EEC/LC_{50})	Chronic RQ (EEC/ NOAEC)
		Single Application			
Cotton / aerial	1lb/A (1 application)	Short grass	240/85	**4.8**	**9.6/3.4**
		Tall grass	110/36	**2.2**	**4.4/1.4**
		Broadleaf plants/Insects	135/45	**2.7**	**5.4/1.8**
		Seeds	15/7	0.30	0.60/0.28
Apples / air blast	2 lb/A (1 application)	Short grass	480/170	**9.6**	**19.2/6.8**
		Tall grass	220/72	**4.4**	**8.8/2.9**
		Broadleaf plants/Insects	270/90	**5.4**	**10.8/3.6**
		Seeds	30/14	**0.60**	**1.2**/0.6
Carrots / broadcast spray	8 lb/A (1 application)	Short grass	1920/680	**38.4**	**76.8/27.2**
		Tall grass	880/288	**17.6**	**35.2/11.5**
		Broadleaf plants/Insects	1080/360	**21.6**	**43.0/14.4**
		Seeds	120/56	**2.4**	**4.8/2.2**
		Multiple Applications			
Cotton / aerial	1lb/A x 4 (6-da interval) 4 lb/A total	Short grass	410/145[2]	**8.2**	**16.4/5.8**
		Tall grass	188/62	**3.8**	**6.9/2.5**
		Broadleaf plants/Insects	230/77	**4.6**	**9.2/3.1**
		Seeds	26/12	**0.50**	**1.0**/0.5
Tomatoes / foliar spray	2 lb/A x 4 (7-da interval) 8 lb/A total	Short grass	757/268	**15.1**	**30.3/10.7**
		Tall grass	347/114	**6.9**	**13.9/4.6**
		Broadleaf plants/Insects	426/142	**8.5**	**17.0/5.7**
		Seeds	47/22	**0.90**	**1.9**/0.9

Table 6: Mammalian (Rat) Acute and Chronic Risk Quotients for Broadcast Spray Applications of Oxamyl to Foliage, Based on a rat LD_{50} of 2.5 mg/kg of body weight (calculated dietary endpoint of 50 mg/kg) and NOAEC of 25 mg/kg in the diet.

Use/App. Method	Rate (Ibs ai/A) x No. Apps.	Food Items	Max/Ave EEC (mg/kg) [1]	Acute RQ (EEC/LC_{50})	Chronic RQ (EEC/ NOAEC)
Potatoes / foliar spray	1 lb/A x 6 (6-da interval) 6 lb/A total	Short grass	422/150	**8.4**	**16.9/6.0**
		Tall grass	194/63	**3.9**	**7.8/2.5**
		Broadleaf plants/Insects	237/79	**4.7**	**9.5/3.2**
		Seeds	26/12	**0.50**	**1.0**/0.5
Levels of Comparison					
Endangered species may be affected (acute risk)				$\geq$ 0.1	
Acute risk may be mitigated through restricted use, in addition to endangered species risk				$\geq$ 0.2	
High acute risk, including endangered species				**$\geq$ 0.5**	
Chronic risk, including endangered species					**$\geq$ 1**

[1] EECs are based on Hoerger and Kenega (1972), modified by Fletcher et al (1994).
[2] For multiple applications, EFED uses EECs based on Hoerger and Kenega (1972) and Fletcher et al (1994), with first-order dissipation from foliage between applications. A foliar dissipation half-life of 5 days, based on published data, was used.

For single and multiple broadcast applications of nongranular products, mammalian acute high, restricted use, and endangered species levels of concern are exceeded for all uses $\geq$1 lb ai/A for all food groups. Chronic LOC's were exceeded for all single and multiple use patterns for most food items using maximum and average EECs to calculate RQs.

The acute toxicity endpoint being used in Table 6 and 7 is not a typical LC_{50}, but a specified quantity of food which can be expected to be consumed in a day for which residues equal a single acute dose. McCann et al. (1981) compared rat LC_{50} values with published rat LD_{50} values. The data showed that the LD_{50} and LC_{50} values for rats can't be used interchangeably and that the LC_{50} values calculated from the LD_{50} values are generally not toxicologically equivalent to actual LC_{50} values from the study. Kenega (1977) made similar observations about avian toxicity tests. McCann (1981) also stated that the calculated values were different 35% of the time when compared to actual LC_{50} values when residue values were held constant. Calculated values, rather than actual LC_{50} values, could result in incorrect decisions in relation to acute hazard as much as 35% of the time. The hazard could be overestimated 29% of the time and underestimated 6% of the time. These are only predictive screening indices of potential hazard. In all cases where actual results from a dietary test (LC_{50}) are available, these results should be factored into the assessment to provide a more realistic picture of dietary hazard potential. In instances where a clear conclusion can't be made from calculated values, the need for a wild mammal dietary test (40 CFR 158.490; guideline 71-3) should be considered.

Table 7: Mammalian (Herbivore/Insectivore and Granivore) Acute Risk Quotients for Broadcast Spray Applications of Oxamyl to Foliage, Based on a Rat LD_{50} of 2.5 mg/kg of body weight.

Site/ Rate in lbs ai/A	Body Weight (g)	EEC, mg/kg [1] Short Grass	EEC Forage/ Small Insects	EEC Large Insects	EEC Seeds	Herbivore/Insectivore Acute RQ[2] Short Grass	Herbivore/Insectivore Forage/ Small Insects	Herbivore/Insectivore Large Insects	Granivore Acute RQ [2] Seeds
Cotton; single application of 1 lb ai/A	15	240	135	15	15	**91.2**	**51.3**	**5.7**	**1.26**
	35	240	135	15	15	**63.4**	**35.6**	**4.0**	**0.90**
	1000	240	135	15	15	**14.4**	**8.1**	**0.9**	0.18
Cotton; 4 applications of 1 lb ai/A	15	410	230	26	26	**157.7**	**88.5**	**10.0**	**2.20**
	35	410	230	26	26	**108.2**	**60.7**	**6.9**	**1.60**
	1000	410	230	26	26	**24.6**	**13.8**	**1.6**	0.31

[1] EECs are based on Hoerger and Kenega (1972), modified by Fletcher et al (1994).

[2] $RQ = \frac{\text{EEC (mg/kg)}}{\text{LD50 (mg/kg)/ \% Body Weight Consumed}}$

where the % body weight consumed varies with body size and diet:.

Herbivores/insectivores: 95% for 15 g wt; 66% for 35 g wt; 15% for 1000 g wt.

Granivores: 21% for 15 g wt; 15% for 35 g wt; 3% for 1000 g wt.

For aerial/ground spray broadcast applications of nongranular products, generally all mammalian high acute risk, restricted use and endangered species LOC's were exceeded at use rates of $\geq$1 lb ai/A. Larger mammals that consume less of a percentage of their body weight per day exhibited lower hazard potential.

Applications to soil

The intent of the following assessment is to evaluate the effect of soil incorporation on the resulting risks for non-granular soil spray applications portrayed through risk quotients. Because of the limited data set available, particularly a lack of toxicity data for species that would normally come in contact with or ingest soil as a part of their diet, the most toxic acute oral endpoint (LD_{50}) was selected for this evaluation. The resultant RQ values are used solely to show, in relative terms, the effect of incorporation in reducing the amount of pesticide available at the surface (i.e., reduce the total amount available for exposure) and, thus, reducing the risk.

Birds and small mammals actively probe the soil while searching for food. While foraging, they are known to ingest soil, both intentionally and incidentally. Beyer, et al. (1994) estimated the soil content of the diet of a number of bird and mammal species to range from <2% to 30%. If this foraging occurs in oxamyl-contaminated fields, wildlife could be exposed to levels of oxamyl high enough to cause ecological effects. This scenario is realistic and represents another route of exposure to oxamyl. Nevertheless, soil incorporation will reduce overall species risk and/or access to the compound.

Unincorporated applications: Bare ground broadcast unincorporated exposures can be calculated on an LD_{50} per square foot basis (Felthousen, 1977). The amount of active ingredient per unit of soil is used to calculate an estimation of exposure to wildlife (Table 8).

Table 8. Avian and Mammalian Acute Risk Quotients From Single Applications of Oxamyl to Soil Without Incorporation.

lbs ai/A	Nontarget organism (surrogate species / average body weight)	LD_{50} (mg/kg) [1]	RQ (LD_{50}/ft^2)
1	Avian (Duck / 1.2 kg) Mammal (Rat / 0.3 kg)	3.2 2.5	2.7 13.8
2	Avian (Duck / 1.2 kg) Mammal (Rat / 0.3 kg)	3.2 2.5	5.4 27.8
4	Avian (Duck / 1.2 kg) Mammal (Rat / 0.3 kg)	3.2 2.5	10.9 55.6
8	Avian (Duck / 1.2 kg) Mammal (Rat / 0.3 kg)	3.2 2.5	21.7 111.2

[1] LD_{50}/ft^2 for broadcast unincorporated applications is calculated as follows:
% unincorporated (decimal)= 1.0 or 100% unincorporated

$$mg/ft^2 = \frac{\text{lb ai/A} \times 1 \text{ (acre)} \times 454{,}000}{43{,}560 \ ft^2}$$

$$LD_{50}/ft^2 = \frac{mg/ft^2}{LD_{50} \ mg/kg \times \text{wt. of organism (kg)}/1000}$$

For unincorporated applications of oxamyl to soil, avian and mammalian high acute, restricted use, and endangered species LOCs are exceeded.

Incorporated banded/in-furrow applications: Banding and incorporation of oxamyl can reduce the amount of the pesticides exposed at the surface. Table 9 uses the LD_{50}/ft^2 concept to illustrate the effect of incorporation and banding on exposure. The amount of active ingredient per unit of soil is used to calculate an estimation of exposure to wildlife. The modeled crops include single soil applications to tomatoes (2 lbs ai/A), potatoes (4 lb ai/A) and carrots (8 lbs ai/A).

Table 9. Avian and Mammalian Acute Risk Quotients From Single Applications of Oxamyl to Soil With Incorporation.

Crop (lbs ai/A)	Bandwidth/ Row Spacing/depth	Nontarget organism (surrogate species / average body weight)	LD_{50} (mg/kg) [1]	RQ (LD_{50}/ft^2)
Tomato (CA) (2)	2"W / 60-66" / 2" Sidedress: shanked in **No incorporation**	Avian (Duck / 1.2 kg) Mammal (Rat / 0.3 kg)	3.2 2.5	5.4 23.2
Potato (4)	2-4"/ 36 inches row center to row center/ 5-6" depth Incorporated at plant	Avian (Duck / 1.2 kg) Mammal (Rat / 0.3 kg)	3.2 2.5	0.1 0.4
Carrot (8)	1" / 12" / 2" Incorporated	Avian (Duck / 1.2 kg) Mammal (Rat / 0.3 kg)	3.2 2.5	0.02 0.09

[1] $LD_{50}/ft^2 = \frac{\text{exposed mg ai}/ft^2}{LD_{50} \times \text{Body wt.}}$
where exposed mg ai/ft^2 = mg ai/ft^2 x % unincorporated (decimal)

Avian and mammalian high acute, restricted use, and endangered species LOCs are exceeded for modeled uses that do not provide soil incorporated applications. However, concentrations may be higher at row-ends and turn areas, thereby possibly increasing hazard in those areas.

Field Studies

Some data were submitted by the registrant in regards to avian and mammalian mortalities in apple orchards in Pennsylvania (MRID 422627-01) and potato fields in New Jersey (MRID 423330-01). The data from the residue monitoring study on apples in Pennsylvania was submitted to assess potential exposure to avian species. In regards to this study, it is interesting to note that concentrations of oxamyl residues on interior non-target vegetation (9 to 129 mg/kg for broadleafs within 24 hrs of application) were similar to estimated Kenega values for 1 lb ai/A (15 to 135 ppm). It appears that the compound may affect certain species of birds for a short period after application if they were to feed on this vegetation. The potato study was a screening study and provided observation and residue data obtained for the purpose of examining the effect of Vydate® L insecticide application on resident wildlife in or near potato fields in New Jersey. Six aerial (by helicopter) applications were made to each of eight treatment fields at 1 lb ai/A at 5 day intervals. The observations and residue data (when compared to known effect values) support the conclusion that Vydate® L applications (in addition to other standard agrichemical usage) do not cause substantial adverse effects upon the resident wildlife with the possible exception of amphibians. Amphibians did appear to be directly affected by Vydate® L application. Many birds, mammals, reptiles and amphibians were found dead on both control and treatment plots, however, due to many factors (trap mortalities, avian transmitter malfunctions, poor carcass condition, etc.), no definitive conclusions could be made. Differences between the RQ assessment and results of the field study are discussed in the risk characterization.

Risk to Nontarget Aquatic Animals

Exposure to aquatic nontarget organisms is possible through surface water runoff, soil erosion, and off-target spray drift. Directions and precautions must be followed in order to reduce the possibility of incidents occurring from the proposed use of oxamyl. EFED used the GENEEC model to predict EEC's in an aquatic environment. Where aquatic LOCs were exceeded with this tier 1 screening estimate, PRZM/EXAMS was used as a tier 2 model refinement. In this case, the Tier 1 assessment resulted in acute restricted use exceedances for freshwater and estuarine/marine fish and acute high risk exceedances for aquatic invertebrates. The input parameters used in the GENEEC model are similar to those used in PRZM/EXAMS. Details on the model inputs can be found in Appendix C.

Freshwater Fish

Acute and chronic risk quotients are tabulated below.

Table 10: Tier 1 (GENEEC) and Tier 2 (PRZM/EXAMS) Risk Quotients for Freshwater Fish Based On a Rainbow Trout LC_{50} of 4.2 mg/l (Acute Endpoint) and a Fathead Minnow NOAEC of 0.5 mg/l (Chronic Endpoint).

Crop	Application Rate x No. Applications at __ day Intervals	Peak EEC (mg/l)	56-60 day Avg. EEC (mg/l) [1]	Acute RQ (Peak EEC / LC_{50})	Chronic RQ (56-60 da EEC / NOAEC)
Tier 1 (GENEEC)					
Apple	2 lb ai/A x 1	0.099	0.021	0.02	0.04
Cotton	1 lb ai/A x 4 at 6 days	0.153	0.032	0.04	0.06
Potato (NE)	1 lb ai/A x 6 at 7 days	0.213	0.045	0.05	0.09
Tomato	2 lb ai/A x 4 at 7 days	0.337	0.072	0.08	0.14
Potato	4 lb ai/A x 2 at 7 days	0.395	0.084	0.09	0.20
Carrots	8 lb ai/A x 1	0.412	0.088	0.10	0.20
Tier 2 (PRZM/EXAMS)					
Apple	2 lb ai/A x 1	0.031	0.001	<0.01	<0.01
Cotton	1 lb ai/A x 4 at 6 days	0.03	0.001	<0.01	<0.01
Carrots	8 lb ai/a x 1 app	0.025	0.0003	<0.01	<0.01
Levels of Comparison					
Endangered species may be affected (acute risk)				$\geq$ 0.05	
Acute risk may be mitigated through restricted use, in addition to endangered species risk				$\geq$ 0.1	
High acute risk, including endangered species				**$\geq$ 0.5**	
Chronic risk, including endangered species					**$\geq$ 1**

[1] The Tier 1 GENEEC model reports 56-day average concentrations; PRZM/EXAMS reports 60-day average concentrations.

No freshwater fish acute or chronic LOC for freshwater fish was exceeded for any modeled use pattern in either the Tier 1 or the Tier 2 assessment. The acute endangered species LOCs for freshwater fish were exceeded for use rates equal to or greater than those of the northeast potato use pattern. However, the RQ values dropped below the LOC when Tier 2 EECs were used. No chronic LOC's for freshwater fish are exceeded for any use patterns.

Freshwater Invertebrates

The acute and chronic risk quotients are tabulated below.

Table 11: Tier 1 (GENEEC) and Tier 2 (PRZM/EXAMS) Risk Quotients for Freshwater Invertebrates Based On a Midge EC_{50} /LC_{50} of 0.18 mg/l (Acute Endpoint) and a Daphnia NOAEC of 1.0 mg/l (Chronic Endpoint).

Crop	Application Rate x No. Applications at __ day Interval	Peak EEC (mg/l)	21 day Avg. EEC (mg/l)	Acute RQ (Peak EEC / LC_{50})	Chronic RQ (21 da EEC / NOAEC)
		Tier 1 (GENEEC)			
Apple	2 lb ai/A x 1	0.099	0.048	**0.55**	0.05
Cotton	1 lb ai/A x 4 at 6 days	0.153	0.073	**0.85**	0.07
Potato (NE)	1 lb ai/A x 6 at 7 days	0.213	0.102	**1.18**	0.10
Tomato	2 lb ai/A x 4 at 7 days	0.337	0.162	**1.90**	0.16
Potato	4 lb ai/A x 2 at 7 days	0.395	0.190	**2.20**	0.19
Carrots	8 lb ai/A x 1	0.412	0.198	**2.30**	0.20
		Tier 2 (PRZM/EXAMS)			
Apple	2 lb ai/A x 1	0.031	0.002	0.20	<0.01
Cotton	1 lb ai/A x 4 at 6 days	0.03	0.003	0.20	<0.01
Carrots	8 lb ai/a x 1 app	0.025	0.001	0.14	<0.01
		Levels of Comparison			
Endangered species may be affected (acute risk)				$\geq$ 0.05	
Acute risk may be mitigated through restricted use, in addition to endangered species risk				$\geq$ 0.1	
High acute risk, including endangered species				**$\geq$ 0.5**	
Chronic risk, including endangered species					**$\geq$ 1**

With Tier 1 EECs, high acute LOCs are exceeded for all use patterns and rates. With Tier 2 EECs, only the restricted use and endangered species acute LOCs were exceeded. Chronic LOC’s for freshwater invertebrates are not exceeded for any use pattern.

Estuarine and Marine Fish

The acute risk quotients are tabulated below.

Table 12: Tier 1 (GENEEC) and Tier 2 (PRZM/EXAMS) Risk Quotients for Estuarine/Marine Fish Based On a Sheepshead Minnow LC_{50} of 2.6 mg/l (Acute Endpoint). No chronic toxicity endpoint was available.

Crop	Application Rate x No. Applications at __ day Interval	Peak EEC (mg/l)	Acute RQ (Peak EEC / LC_{50})
		Tier 1 (GENEEC)	
Apple	2 lb ai/A x 1	0.099	0.04
Cotton	1 lb ai/A x 4 at 6 days	0.153	0.06
Potato (NE)	1 lb ai/A x 6 at 7 days	0.213	0.08
Tomato	2 lb ai/A x 4 at 7 days	0.337	0.13
Potato	4 lb ai/A x 2 at 7 days	0.395	0.15
Carrots	8 lb ai/A x 1	0.412	0.16
		Tier 2 (PRZM/EXAMS)	
Apple	2 lb ai/A x 1	0.031	0.01
Cotton	1 lb ai/A x 4 at 6 days	0.03	0.01
Carrots	8 lb ai/a x 1 app	0.025	0.01
		Levels of Comparison	
Endangered species may be affected (acute risk)			$\geq$ 0.05
Acute risk may be mitigated through restricted use, in addition to endangered species risk			$\geq$ 0.1
High acute risk, including endangered species			**$\geq$ 0.5**

[1] The Tier 1 GENEEC model reports 56-day average concentrations; PRZM/EXAMS reports 60-day average concentrations.

With Tier 1 EECs, acute endangered species LOC's for estuarine/ marine fish are exceeded for the all use rates greater than or equal to the cotton use rate. Also, acute restricted use and endangered species LOC's for estuarine/marine fish were exceeded for use rates greater than or equal to the tomato use rate. Tier 2 EECs show that no estuarine/marine fish acute LOC was exceeded for the modeled use patterns. No toxicity data were submitted to assess chronic risk. Such chronic studies are not being requested because oxamyl degrades rapidly under the alkaline pHs of estuarine/marine environments (half-life of hours).

Estuarine and Marine Invertebrates

Acute risk quotients are tabulated below.

Table 13: Tier 1 (GENEEC) and Tier 2 (PRZM/EXAMS) Risk Quotients for Estuarine/Marine Invertebrates Based On an Eastern Oyster EC_{50} /LC_{50} of 0.40 mg/l (Acute Endpoint). No chronic toxicity endpoint was available.

Crop	Application Rate x No. Applications at __ day Interval	Peak EEC (mg/l)	Acute RQ (Peak EEC / LC_{50})
		Tier 1 (GENEEC)	
Apple	2 lb ai/A x 1	0.099	0.25
Cotton	1 lb ai/A x 4 at 6 days	0.153	0.40
Potato (NE)	1 lb ai/A x 6 at 7 days	0.213	**0.53**
Tomato	2 lb ai/A x 4 at 7 days	0.337	**0.84**
Potato	4 lb ai/A x 2 at 7 days	0.395	**0.99**
Carrots	8 lb ai/A x 1	0.412	**1.03**
		Tier 2 (PRZM/EXAMS)	
Apple	2 lb ai/A x 1	0.031	0.08
Cotton	1 lb ai/A x 4 at 6 days	0.03	0.08
Carrots	8 lb ai/a x 1 app	0.025	0.06
		Levels of Comparison	
Endangered species may be affected (acute risk)			$\geq$ 0.05
Acute risk may be mitigated through restricted use, in addition to endangered species risk			$\geq$ 0.1
High acute risk, including endangered species			**$\geq$ 0.5**

With Tier 1 EECs, high acute risk LOC's for estuarine/marine invertebrates are exceeded for all use rates greater than or equal to the northeastern potato scenario; restricted use and endangered species LOCs were exceeded for all use rates. With Tier 2 EECs, only the endangered species LOC was exceeded for the modeled use patterns. No data were submitted to assess chronic risk. Such chronic studies are not being requested because oxamyl degrades rapidly under the alkaline pHs of estuarine/marine environments (half-life of hours).

Insects

Currently, EFED does not assess risk to nontarget insects. Results of acceptable studies are used for recommending appropriate label precautions. As Oxamyl is moderately to highly toxic to honeybees, precautions with respect to spray drift to flowering plants should be followed.

Exposure and Risk to Endangered Species

There are acute and chronic risks suggestedd for avian and mammalian endangered species from most all single and multiple applications of Oxamyl. The high acute and chronic toxicity of the compound as well as high single application rates, use of multiple applications and use patterns that do not provide for incorporated applications all contribute and exacerbate the risk. Potential risks to aquatic organisms were indicated as well. Results from field studies suggest that endangered/threatened amphibians may also be at risk.

The Endangered Species Protection Program is expected to become final in the future. Limitations in the use of oxamyl may be required to protect endangered and threatened species, but these limitations have not been defined and may be formulation specific. EPA anticipates that a consultation with the U.S. Fish and Wildlife Service (USFWS) will be conducted in accordance with the species-based priority approach described in the Program. After the consultation is completed, registrants will be informed if any required label modifications are necessary. Such modifications would most likely consist of the generic label statement referring pesticide users to use limitations contained in county bulletins.

The Agency has developed a program (the "Endangered Species Protection Program") to identify pesticides whose use may cause adverse impacts on endangered and threatened species, and to implement mitigation measures that will eliminate the adverse impacts. At present, the program is being implemented on an interim basis as described in a Federal Register notice (54 FR 27984-28008, July 3, 1989), and is providing information to pesticide users to help them protect these species on a voluntary basis. As currently planned, the final program will call for label modifications referring to required limitations on pesticide uses, typically as depicted in county-specific bulletins or by other site-specific mechanisms as specified by state partners. A final program, which may be altered from the interim program, will be described in a future Federal Register notice. The Agency is not imposing label modifications at this time. Rather, any requirements for product use modifications will occur in the future under the Endangered Species Protection Program.

The Agency did have a consultation with USFWS on oxamyl as part of the corn cluster assessment in 1981. Oxamyl was found to jeopardize the continued existence of two bird species (Attwaters greater prairie chicken and Aleutian Canada goose) and three insect species (delta green ground beetle, Kern primrose sphinx moth, and valley elderberry longhorn beetle). Using current information, risk to the Canada goose is questionable (exposed in winter), the sphinx moth (not found near corn), and delta green ground beetle (not found near crops). The valley elderberry longhorn beetle would be a concern for the sprays.

Oxamyl was included in our "reinitiation" of clusters in 1988. The 1989 opinion found jeopardy to the Wyoming toad (extirpated in the wild except on FWS refuges), four fish species, and four bird species. In addition, the Agency had "reasonable and prudent measures"[1] to reduce incidental take (not a jeopardy call, but mandatory) of about 20 fish and aquatic invertebrates. This was all based on a 4 lb ai/A rate.

Oxamyl is registered for use on ginger in Hawaii and on yams in Puerto Rico. Hawaii is rich with a diverse and rare bird community, as well as many endangered species. Since oxamyl is acutely and chronically toxic to birds and mammals and it is difficult to quantitatively assess risk in these areas, the following species are listed that may have a potential for exposure in areas where ginger is grown in Hawaii: Hawaii Akepa, Akia Pola'au (Hemignathus munroi), O'u (honeycreeper), Hawaiian hoary bat, Hawaiian coot, Hawaiian crow, Hawaiian duck, Hawaiian goose, Hawaiian hawk, Palila, Hawaiian dark-rumped petrel, Hawaiian monk seal, Newell's Townsend's shearwater, Hawaiian stilt, green sea turtle, hawksbill sea turtle and the leatherback sea turtle.

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[1] Reasonable and prudent measures and alternatives consist of 100 yard ground and 20 yard aerial buffer for most aquatic organisms - double for others. For terrestrial organisms, it was generally requested to keep the compound out of the habitat.

Environmental Risk Characterization

Oxamyl is a highly mobile, water-soluble carbamate insecticide/nematicide/acaricide that is not likely to persist in the environment, especially in neutral to alkaline soils and water, where it is highly susceptible to hydrolysis. Oxamyl is a known cholinesterase inhibitor that is very highly toxic to terrestrial organisms. Acute toxicity and reproductive effects resulting from single doses may occur from the application of oxamyl to foliage. Honey bees and other beneficial insects may be exposed to oxamyl through its use on tree fruits, vegetable crops, and field crops. Field studies suggest that oxamyl will dissipate rapidly from foliage and the soil surface, reducing the probability of prolonged exposure to the chemical. Risk of exposure is further reduced when oxamyl is incorporated into the soil (soil applications include tomato, carrot, celery, citrus, cotton, cucurbit, eggplant, garlic, onion, ginger, non-bearing fruit tree, peanut, pineapple, pepper, soybean, potato, and tobacco). Environmental fate studies suggest that oxamyl may be more persistent when the soil is acidic, the moisture content of the soil is low, and little rainfall occurs.

Depending on the method of application and the site and weather conditions, oxamyl is likely to move by runoff to surface water, leaching to ground water, or a combination of both. Soil incorporation will reduce the amount of oxamyl available at the surface that could move with runoff waters to adjacent fields or water bodies. While oxamyl can reach surface waters by spray drift or runoff, it is not likely to persist (through a combination of hydrolysis in neutral to alkaline waters and photolysis in acidic waters) in most cases and is not expected to pose unacceptable risks to most aquatic organisms, other than risks to freshwater and estuarine/marine endangered invertebrates and risks to non-target freshwater invertebrates that may be mitigated through restricted use classification.

Transformation products detected in the environmental fate studies were oxime and dimethyloxamic acid (DMOA), which may be more mobile and persistent than parent oxamyl, although the available environmental fate and toxicity data are too limited to properly assess and characterize the risks from exposure to these degradates. The only metabolite for which toxicity data were available was DMCF, which was slightly less toxic (LOAEC=450 mg/kg; NOAEC=150 mg/kg) in a 1-generation mammalian reproductive study than the parent oxamyl was in a 2-generation study (LOAEC=75mg/kg; NOAEC=25mg/kg). However, DMCF was not detected in any of the environmental fate studies. Oxime seems to be less toxic to mammals than oxamyl according to the limited data available.

The fate of oxamyl in water will depend on the environmental conditions it encounters. Fate studies and published literature indicate that when oxamyl encounters anaerobic (oxygen-poor) waters or sediment, it degrades more rapidly than it does under aerobic conditions. In waters with a neutral to alkaline pH, oxamyl will hydrolyze more rapidly. Thus, oxamyl is not expected to persist in estuarine or marine waters, where the pH will be alkaline. In acidic waters, oxamyl photolyzes rapidly. Oxamyl may potentially persist in those acidic waters with turbidity high enough to reduce light penetration (limiting photolysis as a route of degradation).

Available monitoring data suggest that oxamyl is more likely to be detected in ground water than in surface water. In the USGS NAWQA program, only one oxamyl detect was reported out of 5,200 surface water samples; in the STORET database, only 14 detects were reported out of more than 3,300 surface water samples. Neither of these studies were targeted specifically in oxamyl use areas or during times of known oxamyl use and, thus, may not necessarily reflect potential peak oxamyl concentrations that may occur in surface waters when runoff events occur shortly after oxamyl is applied. However, the data suggest that oxamyl is not likely to be found in most surface waters and, when it is found, is not likely to persist. Generally, oxamyl is not detected in concentrations >1 ug/l in most surface- or ground-water studies. In ground-water monitoring studies concentrations as high as several hundred ug/l have been reported from very vulnerable areas. More typical maximum concentrations, observed in targeted studies, are up to 4-5 ug/l. Results of prospective ground water monitoring studies indicate that oxamyl is not expected to persist in ground water.

An evaluation of ecological toxicity and environmental exposure data indicate that oxamyl may pose high acute and reproductive hazards to avian and mammalian species if exposed to concentrations that are likely to be found on foliage shortly after only one application. However, oxamyl is expected to dissipate rapidly from foliage and the soil surface (foliar dissipation half-lives range from 1 to less than 5 days; 50% dissipation times in the field range from 3 to 19 days), reducing the probability that a bird or mammal will be exposed to concentrations of oxamyl above the lethal dose after application. Despite its high mobility, oxamyl is not expected to occur in surface waters at concentrations sufficient to exceed levels of concern for most aquatic organisms, other than risks to freshwater and estuarine/marine endangered invertebrates and risks to non-target freshwater invertebrates that may be mitigated through restricted use classification.

Oxamyl appears to function as a quick knockdown agent and is a known cholinesterase inhibitor in avian and mammalian species (U.S. EPA, 1988; Baron, 1991). As such, it is very highly toxic to avian and mammalian species on an acute oral basis, and is moderately toxic to avian species on an acute dietary basis. Avian reproductive parameters were significantly affected in mallard ducks in the form of reduced egg production and fertility. Mammalian reproductive parameters were significantly affected in laboratory rats in the form of reduced body weights during lactation. Acute and reproductive risks to avian and mammalian species were indicated from just one foliar spray application of $\geq$ 1 lb ai/A of oxamyl. RQ's were consistently greater than the LOCs for most use patterns. While oxamyl isn't expected to persist, the acute and reproductive effects may result from a single exposure.

Oxamyl is applied on a wide variety of crops during critical reproductive periods for avian and mammalian species in the spring which may result in high acute and reproductive risks from ingestion of contaminated food items and/or through dermal absorption of the chemical. Reproductive risk quotients, calculated using maximum and average EECs, exceeded LOCs for avian and mammalian species.

Reproductive effects may occur from just one exposure to a carbamate (the cited study used molinate, which is a thiocarbamate herbicide) compound (Jewell et al., 1998). Fluetsch and Sparling (1994) studied avian (mourning doves and American robins) nesting success in organic and conventional (oxamyl was one of the applied compounds) apple orchards. They found that daily survival rates for nests of both species were significantly higher ($p<0.05$) and that species diversity was greater in the organic orchards than in the conventional orchards. Repeated applications of pesticides reduced the reproductive success of both species and may have lowered total avian species diversity in conventional compared with organic orchards. Some recent evidence suggests that carbamate pesticides, oxamyl included, may represent a class of compounds which can function as general endocrine modulators in mammalian cells (Klotz et al., 1997).

Results from actual field residue studies suggest that risk from oxamyl may actually be less than assumed. Thus even accounting for the high toxicity of the compound, risk may be reduced. Field dissipation half-lives ranged from 2 to 3 days on non-target vegetation and soil in studies conducted on apples and potatoes. At application rates of 1 lb ai/A, the highest foliar residue values were 129 mg/kg in the apple study and 603 mg/kg in the potato study. Risk quotients calculated with these values as high-end EECs would still exceed acute and chronic LOCs for avian and mammalian species. Although no dead birds or mammals were observed, amphibian mortalities were reported in these studies. Amphibians appeared to be directly affected by Vydate® L application, possibly due to dermal exposure, repeated applications and to the compound's high water solubility. Effects on amphibians may be due to a higher sensitivity to exposure to oxamyl, although there are no data to confirm this assumption. Since amphibians live in both terrestrial and aquatic habitats, they may have received a greater exposure from combined contaminated habitats. Using data from the rainbow trout (LC50= 4.2 ppm) as a surrogate for amphibians, acute (0.5) and chronic (1.0) LOC's are exceeded based on the reported soil residues (ranges: <0.1 to 26.4 ppm; highest daily mean= 5.7 ppm).

Discrepancies exist between the field data/incident data (inferring lack of bird and mammal mortality) and the finding of high acute and chronic risk to avian and mammalian species in the risk assessment. Two explanations are possible. While oxamyl is very highly toxic to these species, both acutely and chronically, it also has a short terrestrial half-life. The short half-life means that oxamyl concentrations will dissipate rapidly so that, even if it initially occurs at levels that will cause toxic effects, they will not remain at this level for a long period of time. This reduces the probability that a bird or mammal will be exposed to concentrations high enough to cause an adverse effect. However, it is also possible that the field studies did not capture the full magnitude of impact. As with many field studies and incident data, lack of mortality does not necessarily negate risk to the exposed organisms or imply that mortality is not occurring. Birds and mammals may be exposed and then move off-site, leaving the treatment area to die elsewhere unseen. Small mammals may likewise be exposed and die unseen underground in their burrows. Oxamyl, as a known cholinesterase inhibitor, may exert effects that, although reversible, may incapacitate the organism, thus making it an easy target for predators before full recuperation can take effect. In addition, during the summer months, during hot weather, extreme temperatures and stress can exacerbate the toxicity of anti-cholinesterase (AChE) compounds (Rattner, 1982). Chronic effects may go unseen altogether unless years of precise reproduction and population data are collected.

Taking into account modeling and actual field data, the Agency concludes that oxamyl may pose high acute and reproductive hazards to avian, mammalian, and amphibian organisms from applications of only 1 lb ai/A. These hazards may result even from short-term exposures from only single applications. Oxamyl is expected to dissipate rapidly in most environments, thus reducing the time during which potentially toxic levels may occur. Oxamyl may reach marine/estuarine environments because of its use in coastal counties. Despite a refined aquatic assessment, hazard to endangered freshwater and estuarine/marine invertebrates and non-endangered freshwater invertebrates may occur if the compound enters aquatic habitats through runoff and drift from foliar and aerial applications. Acute risks to freshwater invertebrates may produce food chain effects which may impact fish and other organisms that depend on invertebrates as a significant portion of their diet. As in terrestrial environments, oxamyl is expected to be short-lived, thus reducing the probability that invertebrates will encounter the pesticide at toxic levels for extended periods. Risks to freshwater invertebrates may be mitigated through restricted use classification.

Applications utilizing soil incorporation may produce less hazard by limiting the amount of toxicant available to wildlife. Although the compound degrades fairly rapidly in the environment, single as well as multiple applications, with short intervals between applications, may result in environmental concentrations likely to pose both acute and chronic hazard to non-target terrestrial organisms. The high acute and chronic toxicity of the compound as well as high single application rates, multiple applications and use patterns that do not provide for incorporated applications (aerial and broadcast spray) all contribute and exacerbate the risk.

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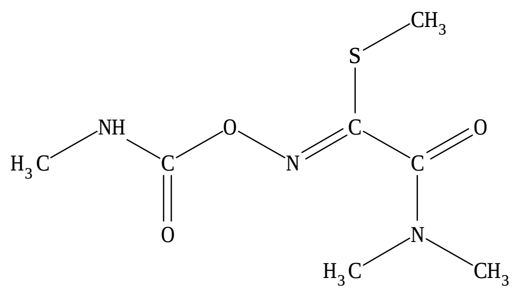
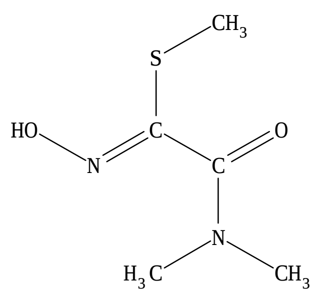
Appendix A: Structure of Oxamyl and Its Major Degradates

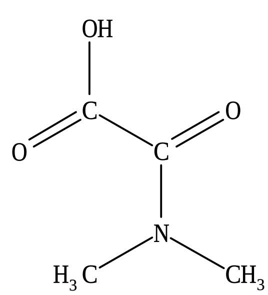
Oxamyl:



Oxime [methyl-2-(dimethylamino)-N-hydroxy-2-oxoethanimidothioate]:



Dimethyloxamic acid [(Dimethylamino)oxoacetic acid]:



Appendix B: Details of Supporting Environmental Fate Studies

The following studies submitted by the registrant were used to develop an environmental fate assessment for oxamyl. The data consist of a combination of acceptable studies that met the appropriate guideline requirements and supplemental studies that provided ancillary information.

161-1 Hydrolysis

Oxamyl is stable to hydrolysis in acidic solutions (half-life is >31 days at pH 5) but hydrolyzes in neutral and basic environments. The half-life of oxamyl was 8 days at pH 7 and 3 hours at pH 9. Oxime was the principle degradation product, accounting for 52% of the applied radioactivity after 8 days and 93% after 30 days at pH 7. At pH 9, oxime accounted for 49% of the applied radioactivity after 3 hours and 83% after 7 hours (MRID 406065-16). These results were similar to a supplemental study (Acc. No. 40494) in which oxamyl concentrations remained stable at pH 4.7, declined by 25% in 4 days at pH 6.9, and by 30% within 6 hours at pH 9.

161-2 Photodegradation in Water

Oxamyl degraded with a half-life of 7 days in a pH 5 buffered solution irradiated with a Xenon lamp source (simulating light intensity for summer sunlight in Wilmington, DE). In contrast, the nonirradiated samples had a half-life of >30 days. Oxime, the principle degradation product, accounted for 41% of the applied radioactivity after 7 days and 75% after 16 days (MRID 406065-15). In a supplemental study (Acc. No. 40494), oxamyl photodegraded in distilled water with a half-life of 11 days at a concentration of 1 mg/kg and 4 days at a concentration of 1000 mg/kg. In both cases, oxamyl was stable in the dark control and oxime was the major degradate (accounting for 21% of the applied at 1 mg/kg and 68% at 1000 mg/kg).

161-3 Photodegradation on Soil

In a supplemental study (Acc. No. 147704), oxamyl degraded at similar rates in irradiated (artificial light) and dark controls on two soils (pH 4.5 Keyport silt loam with 5.6% organic matter and pH 6.5 Cecil sandy loam with 2.1% organic matter). This suggests that non-photolytic processes were responsible for degradation. Major degradates were not identified. However, no additional data are needed because most applications of oxamyl involve soil incorporation.

161-4 Photodegradation in Air

The low vapor pressure (3.8×10^{-7} Torr at 25^{o}C) reported for oxamyl suggests that photolysis in air would not be a major route of degradation.

162-1 Aerobic Soil Metabolism

Oxamyl was applied at rates equivalent to 4 and 20 mg/kg to a surface sample from a Keyport silt loam (pH 6.4; 21% sand, 17% clay; 2.8% organic matter) incubated aerobically in the dark at 25^{o}C and 70% of the 0.33 bar water retention capacity. The rate of metabolism did not follow a first-order kinetics model, with half-lives of 11 days (DT_{50} of 20 days, DT_{90} of 42 days) at 4 mg/kg and 17 days (DT_{50} of 21 days, DT_{90} of >51 days) at 20 mg/kg. CO_2 comprised 48-63% of the applied radioactivity after 51 days (compared to 4-8% evolved from the sterilized soil). Oxime and dimethyloxamic acid comprised less than 4% of the applied radioactivity. Unextracted residues were <30% of the applied radioactivity (Acc. No. 63012).

In a study that evaluated both aerobic and anaerobic soil metabolism, oxamyl degraded with a half-life of 11 days in a sandy clay loam soil incubated aerobically in the dark at 25°C and 75% of 0.33 bar water retention capacity. Oxime (at a maximum of 24% of the applied after 10 days), dimethyloxamic acid (20% of the applied after 21 days), and CO_2 (45% of the applied after 51 days) were the major degradates identified in the aerobic portion (MRID 428200-01).

Oxamyl, at a concentration of 6 mg/kg, degraded with a half-life of 15 days each in surface samples taken from a Cecil loamy sand (pH 6.8) and a Leon sand (pH 6.4). The soils were not further characterized and degradates were not identified (Acc. No. 40494).

After 56 days of aerobic incubation in a supplemental study that measured only $^{14}CO_2$ evolution from soils treated with oxamyl at an equivalent of 4 mg/kg, $^{14}CO_2$ accounted for 56% of the applied radioactivity in an uncharacterized silt loam soil and 90-95% of the applied in uncharacterized sand and loamy sand soils. The rate of metabolism increased as the soil moisture content increased (Acc. No. 154748).

In the aerobic portion of an anaerobic soil metabolism study on a silt loam from a Keyport soil (pH not reported in DER), oxamyl declined with a half-life of 27 days. This rate was similar to that observed In the aerobic portion of the anaerobic study, in which oxamyl declined from 96-98% of the applied radioactivity to 60% after 20 days of aerobic incubation (MRID 413462-01).

162-2 Anaerobic Soil Metabolism

[2 ^{14}C] Oxamyl degraded under anaerobic conditions in a sandy clay loam soil sample from Madera, CA, with a half-life of 6 days. The major degradates were oxime (48% after 7 days; 70% after 20 days; and 57% after 32 days) and dimethyloxamic acid (13% after 7 days; 18% after 20 days; and 23% after 32 days) (MRID 428200-01).

In a supplemental study on a silt loam sample from a Keyport soil (pH not reported in DER), oxamyl declined from 96-98% of the applied radioactivity to 60% after 20 days of aerobic incubation. Under anaerobic conditions (soil flooded with water in a nitrogen atmosphere), oxamyl degraded rapidly ($\leq$1% after 30 days) with an approximate half-life of 5 days. Due to inadequate sampling intervals (0, 30, and 60 days), the half-life value has a high degree of uncertainty. Dimethyloxamic acid comprised 74% of the applied radioactivity after 60 days of flooding. Oxime was $\leq$ 1.5% throughout the study (MRID 413462-01).

Oxamyl, at a concentration of 6 mg/kg, degraded with a half-life of 6 days in surface sample taken from a Keyport silt loam (pH 4.9) when incubated under a nitrogen gas atmosphere (Acc. No. 40494). In another supplemental study, oxamyl, at a concentration of 6 mg/kg, declined with a DT_{50} of <7 days (the long sampling did not allow for a more refined half-life or DT_{50}) in a sample taken from a Keyport silt loam and incubated in a nitrogen gas atmosphere. Oxime comprised 41% of the applied radioactivity at the end of the 42 day study while unidentified polar residues accounted for 42% (Acc. No. 113366).

163-1 Leaching and Adsorption/Desorption

Soil Column Leaching: Oxamyl was highly mobile in a leaching study using 12"-high columns packed with surface soil samples from a Fayetteville loamy sand, Keyport silt loam, Sassafras sandy loam, and Tama loam (Table B-1). In unaged samples, 89-95% of the applied radioactivity was leached from the columns with 1000 ml of water. The amount of leached radioactivity decreased to 67% when oxamyl was aged for 7 days in a silt loam sample and to 37% after 18 days of aging. The degradates oxime and dimethyloxamic acid were detected in the leachate from both unaged and aged soil columns (MRID 406065-14).

In another column leaching study, 100% of the applied oxamyl leached through an 18-inch long soil column filled with a sandy loam (59% sand, 10% clay; 0.8% organic matter) while 83% leached through a similar column filled with a silt loam (5% sand, 31% clay; 4% organic matter). Both columns were leached with an equivalent of 20 inches of water over a 1-2 day period. When oxamyl residues were aerobically aged in the same soils for 30 days, 61 to 63% of the applied radioactivity was recovered in the leachate (Acc. No. 141395).

Table B-1: Results of Unaged and Aged Soil Column Leaching Studies (MRID 406065-14).

Parameter	***Sassafras sandy loam***	***Tama loam***	***Fayetteville loamy sand***	***Keyport silt loam***		
				unaged	***aged 7 da***	***aged 18 da***
% clay	9	24	9	19		
% sand	74	32	81	18		
% OM	1.0	5.1	2.0	1.9		
pH	6.3	7.3	5.4	4.3		
CEC, meq/100g	3.5	24.7	4.9	10.7		
% retained on soil	11	6	5	5	22	28
% ttl in leachate	89	94	95	95	67	37
oxamyl	19	nd	50	83	50	21
oxime	54	80	27	nd	nd	2
oxamic acid	16	14	17	13	17	14
Kd (1)	0.05	0.41	0.08	-0.06	0.52	--

(1) Non-Freundlich K_d values, based on the volume of water required to leach 50% of the applied radioactivity from the column compared to that of a tracer (^{36}Cl), calculated as:

$$K_d = \left(\frac{\text{vol. to elute 50\% } ^{14}C}{\text{vol. to elute 50\% } ^{36}Cl} - 1\right) \times \frac{\text{vol. to elute 50\% } ^{14}C}{\text{dry wt. soil in column}}$$

Batch Equilibrium/Adsorption-Desorption: In a supplemental batch equilibrium study in which the soil and experimental conditions were not fully characterized, Freundlich K_{ads} values for oxamyl ranged from 0.02 to 0.40 ml/g and K_{oc} values ranged from 6 to 12 ml/g (Acc. No. 154748; Table B-2). In another supplemental batch equilibrium study (incomplete soil characterization soils, unspecified experimental conditions), oxamyl did not adsorb to Cecil loamy sand, Keyport silt loam, or Butlertown silt loam soil samples (Acc. No. 40494).

Table B-2: K_f, n, and K_{oc} Values For Oxamyl on Five Uncharacterized Soils (Acc. No. 154748).

Soil	K_f, ml/g	***n***	K_{oc}, ml/g
Webster silty clay	0.40	0.97	12
Grenada silt loam	0.07	0.96	8
Cecil loamy sand	0.05	0.92	6

Table B-2: K_f, n, and K_{oc} Values For Oxamyl on Five Uncharacterized Soils (Acc. No. 154748).

Soil	***K_f***, ml/g	***n***	***K_{oc}***, ml/g
Eustis Ap fine sand	0.06	0.96	9
Eustis B1 fine sand	0.02	0.77	12

Open Scientific Literature: Additional supplemental information on the mobility of oxamyl can be found in the published scientific literature. Although not specifically designed to meet EPA study guidelines, published studies by Bilkert and Rao (1985) and Bromilow et al (1980) provide supporting evidence that oxamyl is mobile. Reported K_d values measured for 9 different soils in the 2 studies ranged from 0.02 to 0.62 ml/g while K_{oc} values were 10 ml/g or less in 8 of the 9 soils.

163-2 Volatility -- Laboratory

The low vapor pressure (3.8×10^{-7} Torr at 25° C) reported for oxamyl suggests that volatility should not be a major route of dissipation.

164-1 Terrestrial Field Dissipation

In terrestrial field dissipation studies conducted on different crops in 3 states (cucumbers in FL, cotton in CA, cherry orchard in WA), detectable levels of oxamyl occurred in the lowest sampling depth (90 cm) in FL and WA study sites 30 to 59 days after application. Oxamyl residues were also detected, but not confirmed, in the 60-90 cm depth at a CA study site. These studies show that leaching through the soil profile is a possible dissipation pathway for oxamyl. Design problems limit the interpretation and extrapolation of the study results. Dissipation half-lives ($t_{1/2}$) from the surface layer ranged from 9 to 62 days. However, because the application rate, nominally 18 lb a.i./acre in all three studies, was not confirmed in the WA study, these half-lives are semi-quantitative at best. DT_{50} values for oxamyl in the surface were 3-4 days in CA and FL and approximately 19 days in WA; DT_{90} values were roughly 4 days in FL, 38 days in CA, and 76 days in WA. The studies also analyzed combined oxamyl and oxime residues. The $t_{1/2}$, DT_{50}, and DT_{90} values, respectively, for the combined residues were 16, 4 and 7 days in FL; 70, 39, and 68 days in WA; and 42, 30, and 91 days in CA (MRIDs 415732-01 and 419639-01).

In a supplemental study conducted on a Mattapeake silt loam (pH 6.0, 1.5% organic matter) in northern Delaware, oxamyl was applied to the surface at a rate of 5.65 lb ai/A. The DT_{50} for the surface 4 inches was 4 days; the DT_{90} was 21 days. Oxamyl was detected to the lowest sampling depth (24-30 inches) from 5 through 23 days after treatment (40494).

Oxamyl residues were detected to a depth of 74 inches 25 days after application (4 lb ai/ac) on one acidic (pH 4.8) potato field study site in Long Island. In a second field, oxamyl applied at 3.4 lb ai/ac was detected to a depth of 26 inches 21 to 74 days after application. At 3.0 lb ai/ac on a near-neutral soil (pH 6.8), oxamyl residues were detected to a depth of 14 inches 75 days after application. The study sites were not adequately characterized and the sampling intervals were not sufficient to determine a rate of decline (145302).

In a supplemental study (no pretreatment or day 0 concentrations determined; inadequate soil, site, weather characterization; incomplete description of analytical methods) conducted on a lemon grove in California, oxamyl was applied in monthly irrigation waters at a rate of 1 lb ai/acre for a total of 10 lb ai/acre. The soils were alkaline (pH 7.3 to 8.5), predominantly sandy (sandy loam to loamy sand surface; sand to silt loam subsurface), and low in organic matter (<1%). Oxamyl residues were detected to 48 inches 35 days after the last application. In the second year of study, an additional 7 lb ai/acre was applied in monthly intervals of 1 lb ai/acre. Oxamyl residues in the surface 4 inches declined from 0.13 mg/kg 1 day after the last application to 0.04 mg/kg after 4 days; oxime residues declined from 0.09 mg/kg at day 1 to 0.05 mg/kg after 4 days and <0.03 mg/kg after 7 days. In a second study conducted on the same site, oxamyl applied at a rate of 10 lb ai/acre in irrigation water declined in the surface 4 inches from 1.15 mg/kg 1 day after last application to $\leq$ 0.03 mg/kg from 4 to 14 days after the last application; oxime residues increased from 1.02 mg/kg at day 1 to 1.53 mg/kg at day 4 before declining to 0.71 mg/kg after 7 days and 0.37 mg/kg after 14 days. Both oxamyl and oxime residues were detected at the maximum depth of sampling (48 inches). Because pretreatment and day 0 concentrations were not analyzed, neither study provides enough information to determine half-lives or DT_{50}s (Acc. No. 149231).

164-2 Aquatic Field Dissipation

This study is not required for terrestrial and greenhouse uses.

Non-Guideline Ground-Water Monitoring Studies

Oxamyl was detected at concentrations of 5.0 to 5.4 µg/L in three shallow wells (9 to 12 feet deep) installed within 10 feet of a potato field on Long Island, NY. The detections occurred on July 24, 1981, after total applications of 6 and 9 lb ai/acre in 1980 and 1981. No oxamyl residues were detected in the wells (limit of detection of <5 ppb) in subsequent sampling between August and December, 1981. No oxamyl residues were detected in 8 other existing wells located within 30 to 400 feet of potato fields treated at yearly rates of 3 to 11 lb ai/acre (Acc. No. 96623).

165-4 Accumulation in Fish

The data requirements for bioaccumulation in fish have been waived because of the low water/octanol partition coefficient of oxamyl (K_{ow} = 0.33).

Appendix C: Surface Water Modeling: Input Parameters, Files, and Summary Tables

Environmental Fate Input Values

Environmental fate inputs to PRZM and EXAMS are listed along with their sources in Table C-1. Soil, cropping and management inputs to PRZM are those selected by the PIC (PRZM Input Collator) data base. EXAMS environment inputs are taken from the Georgia pond scenario.

Table C-1. PRZM/EXAMS environmental fate input parameters for Oxamyl.

Parameter	Value	Data source
Molecular Weight	219	
Solubility	2.8×10^5	
Vapor Pressure (torr)	3.8×10^{-7}	
Henry's Law Constant	2.38×10^{-7}	
pH 5 Hydrolysis Half-life (days)	stable	MRID 40605-16(c), ACC No. 40494 (s)
pH 7 Hydrolysis Half-life (days)	8 days	MRID 40605-16(c), ACC No. 40494 (s)
pH 9 Hydrolysis Half-life (days)	3 hours	MRID 40605-16(c), ACC No. 40494 (s)
Soil Photolysis Half-life (days)	stable	Acc. No. 147704
Aquatic Photolysis Half-life (days)	11 days	MRID 406065-15 Acc. No. 40494
Aerobic Soil Metabolism Half-life	20 days	MRID 428200-01 (c), 413462-01 (s), Acc. No. 63012 (c), 40494 (s), 154748 (s)
Aerobic Aquatic Metabolism Half-life	stable [1]	No data available
Anaerobic Soil Metabolism Half-life	7 days	MRID 428200-01 (c), 413462-01 (s), Acc. No. 4094 (s), 113366 (s)
Soil-Water Partitioning Coefficient K_d (K_{oc})	0.02 L/kg (6 L/kg)	Acc. No.154748 (s), 40494 (s)
Application Rate	8 lb a.i./acre (carrots) 2 lb a.i./ acre (non-bearing fruit) 1 lb a.i./acre (cotton)	Vydate® L Label
Maximum Application Per Year	8 lb a.i./acre (carrots) 8 lb a.i./ acre (non-bearing fruit) 1 lb a.i./acre (cotton)	Vydate® L Label

[1] Although oxamyl isn't expected to presist in water, no data are available to estimate an aquatic metabolism degradation rate. The current EFED input guidance recommends that the aerobic soil metabolism rate be multiplied by 0.5 (equivalent to doubling the half-life) when no aerobic aquatic metabolism data are available (resulting in a surrogate half-life of 40 days). However, hydrolysis will be the dominant route of dissipation in neutral water, so that a surrogate aquatic dissipation half life of 40 days isn't going to result in a major difference in the EECs. For this reason, no rate was entered for the KBACW in EXAMS.

Description of Modeled Scenarios

One site/scenario used to represent oxamyl use on non-bearing apple trees represents an orchard/vineyard in Columbia County, New York, in Major Land Resource Area (MLRA) 144B. On the site it is assumed that grass covers the surface below the trees and that applied pesticide lands either on the trees or the grass below. The soil at the site is a Cabot silt loam. Data for this soil was taken from the PIC database and the USDA Natural Resource Conservation Service's 1987 Natural Resources Inventory. Cabot silt loam is hydrologic group D soil; runoff curve numbers were generated based on this grouping and the plant cover. A total of 3070 acres of apples, about 0.5% of the U.S. total, were grown in Columbia County in 1997 (USDA, 1999). Weather data was taken from weather station W04725 in Albany, NY. The weather data file is part of the PRZM program and is used to represent the weather for MLRA 144B. This site receives an annual average precipitation of about 93 cm, of which 19% on the average leaves site as runoff. The chemical specific parameters used in PRZM3 and EXAMS to describe the scenario can be found in Appendix C. Information on pesticide use and application timing was provided by Richard Struob, Cornell University, Hudson Valley Laboratory, Highland, NY. The site was selected to represent orchards and vineyards in the eastern United States that are likely to present high exposure to aquatic organisms.

Estimated runoff from oxamyl use on cotton was simulated using 4 applications at 6-day intervals on a field is in Yazoo County, Mississippi. The modeled soil is a Loring silt loam, a fine-silty, mixed, mesic Thermic Typic Fragiudalf, in MLRA O-134. The Loring silt loam is a moderately well drained soil with a fragipan formed in loess on level to strongly sloping upland and on stream terraces with slopes of 0-20 percent. The Loring silt loam is a Hydrologic Group C soil with runoff curve numbers that were measured on a real field in Yazoo County, Mississippi, under cotton culture. According to the 1997 Census of Agriculture, greater than 112,000 acres of cotton are grown in Yazoo County, which is among the top 50 counties in the U.S. (information can be found on the USDA National Agricultural Statistics Service web site at http://www.nass.usda.gov/census/). USLE C Factors were developed by George Foster at the University of Mississippi in consultation with Ronald Parker of the US EPA to represent a cotton field with one year tilled followed by two years under conservation tillage using RUSLE. The weather data is from weather station W03940 in Jackson, Mississippi. The weather data file is also part of the PIRANHA shell and is used to represent the weather for MLRA 131. This weather data was used rather than the MLRA 140 weather data as it was expected to better represent the weather in Yazoo County.

A similar scenario was used to model oxamyl use on carrots. Oxamyl is registered for use on carrots in all states except for California. According to the 1997 Ag Census (USDA, 1999) 49579 acres of carrots were planted outside of California. According to the current Vydate L label oxamyl can be applied to carrots as a single application at 8 lb a.i./per acre. For the carrot scenario the site used in the simulation was a field in Oceana or Newaygo counties in Michigan. These two counties represent about 4 % of the acres of carrots grown in the U.S. outside of California. The soil unit used in the simulation was the Perrington loam in MLRA 96. Data for this soil was taken from the PIC database and the USDA 1987 Natural Resources Inventory. The Perrington loam is hydrologic group C soil and runoff curve numbers were generated based on this grouping and the plant cover. Cropping practice and pesticide application information was provided by the Michigan State Extension Service office in Freemont, Michigan.

PRZM 3.1.2 Input Data File, OxCOTTON.INP, for Oxamyl on COTTON

```
*** Location: Yazoo County, Mississippi; MLRA: O-134 ***
*** Weather: MET134.MET Jackson, MS ***
*** Manning's N: Assume fallow surface with residues not more than 1 ton/acre ***
Oxamyl
Location: Jackson Co. MS    Crop: cotton    MLRA 134
   0.76    0.15      0   17.00       1       1
     4
   0.49    0.40    0.75   10.00    5.80       4    6.00   354.0
     3
     1    0.20  125.00   98.00       3  85  78  77              0.00  120.00
     2    0.20  125.00   98.00       3  79  69  68              0.00  120.00
     3    0.20  125.00   98.00       3  84  68  68              0.00  120.00
     1       3
0105 0709 2209
0.63 0.16 0.18
0.17 0.17 0.17
     2       3
0105 0709 2209
0.16 0.13 0.13
0.17 0.17 0.17
     3       3
0105 0709 2209
0.16 0.13 0.09
0.17 0.17 0.17
    36
  01 548  07 948  220948       1
  01 549  07 949  220949       2
  01 550  07 950  220950       3
... repeating in 3-year sequences ...
  01 581  07 981  220981       1
  01 582  07 982  220982       2
  01 583  07 983  220983       3
Application Schedule: 4 applications of 1.0 pound a.i./acre
    144      1       0       0
Oxamyl Koc:6 AeSM: T1/2=20 days, AnSM: T1/2=7 days
  150448  0 2 0.00  2.24 0.75 0.15
  210448  0 2 0.00  2.24 0.75 0.15
  270448  0 2 0.00  2.24 0.75 0.15
  030548  0 2 0.00  2.24 0.75 0.15
... repeating at the same rates on the same dates in each year ...
  150483  0 2 0.00  2.24 0.75 0.15
  210483  0 2 0.00  2.24 0.75 0.15
  270483  0 2 0.00  2.24 0.75 0.15
  030583  0 2 0.00  2.24 0.75 0.15
    0.       1    0.00
    0.0     0.0     0.5
Soil Series: Loring silt loam; Hydrogic Group C
  125.00    0.00  0   0   0   0   0   0   0   0   0
   0.00    0.00   00.00
     3
     1   10.00   1.600   0.294   0.000   0.000   0.000
       0.035   0.035   0.000
        0.100   0.294   0.094   1.160    0.02
     2  10.000   1.600   0.294   0.000   0.000   0.000
       0.100  0.100   0.000
        0.500   0.294   0.094   1.160    0.02
     3 105.000   1.800   0.291   0.000   0.000   0.000
       0.100  0.100   0.000
        5.000   0.147   0.087   0.174    0.02
     0
   WATR    YEAR     10    PEST    YEAR     10    CONC    YEAR     10   1
     4
```

8 Oxamyl
5 DAY
RFLX TSER 0 0 1.E5
EFLX TSER 0 0 1.E5
ESLS TSER 0 0
RUNF TSER 0 0
PRCP TSER 0 0

Yearly Summary of Oxamyl Concentrations in the Water Column From Use on MS Cotton

YEAR	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
----	----	-------	------	------	------	------
1948	16.800	2.697	2.026	0.711	0.474	0.194
1949	16.800	2.650	2.018	0.707	0.471	0.194
1950	16.810	3.878	2.022	0.801	0.534	0.223
1951	16.810	2.786	2.051	0.719	0.479	0.195
1952	16.800	2.650	2.018	0.707	0.471	0.194
1953	16.800	2.819	2.080	0.729	0.486	0.203
1954	16.810	2.676	2.030	0.711	0.474	0.196
1955	16.800	2.650	2.018	0.707	0.471	0.196
1956	16.800	2.682	2.025	0.724	0.483	0.199
1957	23.130	3.669	2.213	0.783	0.522	0.215
1958	16.870	3.463	2.238	0.784	0.523	0.225
1959	16.800	2.650	2.018	0.707	0.471	0.194
1960	16.800	3.028	2.022	0.735	0.490	0.201
1961	16.800	2.906	2.026	0.729	0.486	0.202
1962	16.800	2.654	2.019	0.712	0.475	0.197
1963	16.800	2.650	2.018	0.707	0.471	0.195
1964	24.200	4.163	2.307	0.808	0.539	0.229
1965	16.800	2.650	2.018	0.749	0.499	0.209
1966	16.800	4.398	2.356	0.826	0.550	0.224
1967	16.830	4.868	2.517	0.886	0.590	0.247
1968	16.800	2.674	2.023	0.710	0.473	0.199
1969	16.800	2.650	2.018	0.708	0.472	0.193
1970	16.810	3.999	2.502	0.876	0.584	0.245
1971	16.800	2.650	2.018	0.707	0.471	0.193
1972	16.820	2.876	2.068	0.724	0.483	0.196
1973	27.210	6.778	2.836	0.993	0.662	0.282
1974	79.400	12.520	3.899	1.365	0.910	0.375
1975	29.100	4.590	2.398	0.840	0.560	0.233
1976	16.800	2.651	2.019	0.707	0.471	0.193
1977	16.800	2.650	2.019	0.716	0.477	0.197
1978	27.970	4.540	2.373	0.841	0.561	0.234
1979	36.670	5.830	3.222	1.128	0.752	0.327
1980	16.800	2.650	2.018	0.707	0.472	0.196
1981	16.800	2.650	2.018	0.714	0.476	0.193
1982	16.900	3.781	2.247	0.804	0.536	0.220
1983	16.800	2.877	2.063	0.725	0.484	0.200
1/10	28.309	5.157	2.613	0.918	0.612	0.258

MEAN OF ANNUAL VALUES = 0.217
STANDARD DEVIATION OF ANNUAL VALUES = 0.039
UPPER 90% CONFIDENCE LIMIT ON MEAN = 0.227

PRZM 3.1.2 Input Data File, OxAPPLE.INP, for Oxamyl on APPLES

```
*** Changed from Glufosinate ammonium to oxamyl, September 1,1998
*** Mannings N value for sparse grass under trees ***
*** Original file used Sharky Clay loam; changed to Cabot silt loam; 3% of MLRA ***
Oxamyl
Columbia Co, New York; MLRA 144B Apples, Crab Apples, Quince
   0.850   0.450       2  20.000       1       3
    9.7    10.4    11.8    13.1    14.3    14.8
   14.5    14.0    12.3    11.0     9.8     9.1
      4
   0.01    0.01     1.0    10.0     3.8       3   12.00   354.0
      1
      1    0.30    60.0  90.000       3  94  84  89               0.00   500.0
      1       3
0103 0111 0101
0.74 0.01 0.01
0.015 0.015 0.015
     36
  010448  150548  151248       1
  010449  150549  151249       1
... repeated yearly ...
  010482  150582  151282       1
  010483  150583  151283       1
Application Schedule: 4 ground spray @ 2.0 lb/acre, 75% eff w/5% drift
    144       1       0
Oxamyl:  koc = 6; AeSM: T1/2 = 16 d
  150448  0 2 0.00  2.24 0.75 0.15
  010548  0 2 0.00  2.24 0.75 0.15
  150548  0 2 0.00  2.24 0.75 0.15
  290548  0 2 0.00  2.24 0.75 0.15
... repeating at the same rates on the same dates in each year ...
  150483  0 2 0.00  2.24 0.75 0.15
  010583  0 2 0.00  2.24 0.75 0.15
  150583  0 2 0.00  2.24 0.75 0.15
  290583  0 2 0.00  2.24 0.75 0.15
    0.0       1     0.0
    0.0     0.0     0.5
Cabot silt loam; Hydrologic Group D;
   100.0     0.0   0   0   0   0   0   0   0   0   0
   0.00    0.00    0.00
      3
*** DWRATE = aerobic met rate, t1/2 = 20,DWRATE1=DSRATE1=0.035
*** DWRATE2&3 = anaerobic met rate t1/2 = 7, DWRATE 2&3 = DSRATE 2&3 = 0.1
      1    20.0    1.10   0.288     0.0     0.0
          0.035  0.035   0.000
           0.2   0.288   0.108   6.961     0.05
      2    16.0    1.70   0.197     0.0     0.0
           0.1   0.1     0.000
           2.0   0.197   0.037   0.290     0.05
      3    64.0    1.90   0.151     0.0     0.0
           0.1   0.1     0.000
           2.0   0.151   0.041   0.174     0.05
      0
          YEAR       5           YEAR       5           YEAR       5   1
      6
      1  -----
      6    YEAR
    PRCP    TCUM   0   0
    RUNF    TCUM   0   0
    RFLX    TCUM   0   0   1.0E5
    EFLX    TCUM   0   0   1.0E5
    ESLS    TCUM   0   0   1.0E3
    RZFX    TCUM   0   0   1.0E5
```

Yearly Summary of Oxamyl Concentrations in the Water Column From Use on NY Apples

YEAR	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
1948	16.800	2.655	1.457	0.882	0.588	0.243
1949	19.240	3.035	1.161	0.789	0.538	0.217
1950	16.800	4.675	1.508	0.939	0.626	0.248
1951	16.800	2.650	1.010	0.781	0.524	0.204
1952	16.810	3.483	1.407	0.846	0.630	0.249
1953	22.850	3.605	1.273	0.819	0.548	0.216
1954	20.700	5.777	1.677	1.120	0.747	0.298
1955	30.760	4.851	1.429	0.854	0.571	0.225
1956	16.810	4.043	1.312	0.814	0.552	0.218
1957	16.800	2.650	1.501	0.879	0.599	0.242
1958	16.800	2.974	1.192	0.847	0.567	0.218
1959	36.160	5.704	1.637	1.110	0.740	0.283
1960	16.810	2.943	1.208	0.819	0.582	0.231
1961	20.690	3.263	1.207	1.037	0.695	0.277
1962	16.910	2.835	1.046	0.784	0.522	0.210
1963	17.500	3.797	1.417	0.852	0.605	0.239
1964	16.920	4.013	1.297	0.833	0.619	0.246
1965	16.800	2.697	1.233	0.796	0.530	0.209
1966	28.210	4.450	1.353	1.070	0.713	0.284
1967	28.140	4.438	1.612	0.917	0.617	0.241
1968	30.880	5.039	1.558	0.943	0.629	0.250
1969	16.800	2.650	1.010	0.707	0.509	0.200
1970	16.800	3.533	1.209	0.795	0.541	0.214
1971	16.800	2.878	1.560	0.945	0.633	0.249
1972	16.800	3.234	1.207	0.826	0.566	0.221
1973	16.870	2.741	1.090	0.735	0.490	0.196
1974	16.800	2.719	1.081	0.732	0.491	0.196
1975	23.640	3.729	1.352	0.917	0.615	0.236
1976	19.680	3.103	1.149	0.801	0.542	0.213
1977	16.800	2.680	1.204	0.800	0.534	0.205
1978	16.800	2.705	1.030	0.733	0.491	0.199
1979	16.800	2.650	1.188	0.774	0.516	0.204
1980	16.800	2.741	1.085	0.733	0.545	0.214
1981	18.190	2.869	1.085	0.733	0.506	0.200
1982	17.340	4.199	1.397	0.899	0.602	0.238
1983	58.740	9.414	2.440	1.250	0.839	0.342
1/10	30.796	5.239	1.620	1.082	0.721	0.283

MEAN OF ANNUAL VALUES = 0.233
STANDARD DEVIATION OF ANNUAL VALUES = 0.032
UPPER 90% CONFIDENCE LIMIT ON MEAN = 0.241

PRZM 3.1.2 Input Data File, MICarrot.INP, for Oxamyl on Carrots

```
*** Carrots in Oceana and Newaygo Counties ***
*** Crop information recived and pesticide application info from Rodger Peacock ***
***     and Jim Brinland, Michigan State Extension service, Freemont, MI (231) 924-0500 ***
Oxamyl
Perrinton loam,  MLRA 96 Class C
  0.780   0.300      0   14.00      1      3
     4
   0.29    1.00    1.00   10.00   5.40       3    6.00   354.0
     1
     1    0.10   20.00   80.00      3  91  85  88              0.00    35.0
     1      3
0101 0105 1009
0.50 0.50 0.50
.023 .023 .023
     36
  160548  060948  200948       1
  160549  060949  200949       1
... repeated yearly ...
  160582  060982  200982       1
  160583  060983  200983       1
Application Schedule: 1 app @8 lb a.i/a, incorporated to 4 inches
     36      1      0
Oxamyl Koc: 6 AeSM: T1/2=20 days
  200548  0 4 4.00 8.960 1.00 0.00
  200549  0 4 4.00 8.960 1.00 0.00
... application repeated yearly at the same rate on the same date...
  200582  0 4 4.00 8.960 1.00 0.00
  200583  0 4 4.00 8.960 1.00 0.00
    0.0      1     0.0
***  0.0    0.00     0.0
Perrinton Loam; Hydrologic Group C;
  100.00          0   0   0   0   0   0   0   0   0
    0.0    0.00    0.00
     4
     1   10.00   1.400   0.294   0.000   0.000   0.000
         0.035   0.035   0.000
          0.10   0.377   0.207   1.160   1
     2    8.00   1.400   0.377   0.000   0.000   0.000
           0.1     0.1   0.000
          1.00   0.377   0.207   1.160   1
     3   54.00   1.500   0.292   0.000   0.000   0.000
           0.1     0.1   0.000
          2.00   0.292   0.132   1.160   1
     4   28.00   1.800   0.285   0.000   0.000   0.000
           0.1     0.1   0.000
           2.0   0.285   0.125   0.174   1
     0
         YEAR      5          YEAR      5          YEAR      5   1
     1
     1  -----
     6    YEAR
   PRCP    TSER   0   0
   RUNF    TSER   0   0
   ESLS    TSER   0   0  1.0
   RFLX    TSER   0   0  1.0E5
   EFLX    TSER   0   0  1.0E5
   RZFX    TSER   0   0  1.0E5
```

Yearly Summary of Oxamyl Concentrations in the Water Column From Use on MI Carrots

YEAR	PEAK	96 HOUR	21 DAY	60 DAY	90 DAY	YEARLY
----	----	-------	------	------	------	------
1948	0.436	0.069	0.013	0.005	0.004	0.001

1949	14.600	2.336	0.445	0.157	0.105	0.046
1950	1.922	0.303	0.059	0.021	0.014	0.006
1951	3.045	0.480	0.097	0.034	0.023	0.009
1952	3.284	0.798	0.154	0.054	0.036	0.015
1953	3.422	0.652	0.124	0.047	0.032	0.014
1954	11.950	3.025	0.667	0.238	0.159	0.065
1955	63.630	10.040	1.944	0.682	0.455	0.184
1956	1.420	0.224	0.045	0.019	0.013	0.005
1957	8.770	1.384	0.264	0.097	0.064	0.026
1958	14.360	2.265	0.432	0.152	0.101	0.045
1959	2.049	0.323	0.062	0.040	0.027	0.011
1960	24.680	3.921	0.748	0.264	0.177	0.079
1961	0.010	0.002	0.000	0.000	0.000	0.000
1962	0.256	0.040	0.008	0.003	0.002	0.001
1963	1.201	0.308	0.070	0.025	0.016	0.007
1964	1.137	0.179	0.034	0.012	0.008	0.003
1965	0.263	0.041	0.008	0.003	0.002	0.001
1966	2.805	0.442	0.084	0.030	0.020	0.008
1967	38.780	6.828	1.301	0.456	0.304	0.132
1968	0.942	0.156	0.037	0.013	0.009	0.004
1969	1.813	0.286	0.072	0.025	0.017	0.007
1970	5.717	0.902	0.185	0.065	0.043	0.017
1971	8.250	1.315	0.251	0.090	0.060	0.027
1972	9.711	1.544	0.299	0.105	0.070	0.028
1973	7.709	1.216	0.234	0.083	0.055	0.022
1974	4.595	0.725	0.138	0.048	0.032	0.013
1975	7.735	1.220	0.243	0.088	0.059	0.023
1976	25.330	3.995	0.761	0.267	0.178	0.075
1977	5.966	0.941	0.227	0.080	0.053	0.023
1978	2.190	0.345	0.078	0.027	0.018	0.007
1979	0.745	0.117	0.024	0.009	0.006	0.002
1980	1.442	0.360	0.103	0.036	0.024	0.010
1981	4.947	0.780	0.155	0.054	0.036	0.015
1982	22.820	3.599	0.702	0.247	0.165	0.065
1983	0.236	0.037	0.014	0.006	0.004	0.002
1/10	24.875	3.943	0.752	0.265	0.177	0.076

MEAN OF ANNUAL VALUES = 0.028
STANDARD DEVIATION OF ANNUAL VALUES = 0.039
UPPER 90% CONFIDENCE LIMIT ON MEAN = 0.037

EXAMPLE GENEEC Run and Output:

Pineapples

```
 RUN No.   1 FOR oxamyl          INPUT VALUES
  --------------------------------------------------------------------
   RATE (#/AC)    APPLICATIONS   SOIL   SOLUBILITY   % SPRAY INCORP
    ONE(MULT)     NO.-INTERVAL   KOC      (PPM)       DRIFT  DEPTH(IN)
  --------------------------------------------------------------------
  2.000(  5.858)   6   14          6.0 280000.0          .0      .0

  FIELD AND STANDARD POND HALFLIFE VALUES (DAYS)
  --------------------------------------------------------------------
  METABOLIC  DAYS UNTIL  HYDROLYSIS   PHOTOLYSIS   METABOLIC  COMBINED
   (FIELD)   RAIN/RUNOFF   (POND)     (POND-EFF)    (POND)     (POND)
  --------------------------------------------------------------------
    27.00        0           8.00   11.00- 1349.70    .00        7.95

  GENERIC EECs (IN PPB)
  --------------------------------------------------------
      PEAK       AVERAGE 4     AVERAGE 21    AVERAGE 56
      GEEC       DAY GEEC       DAY GEEC      DAY GEEC
  --------------------------------------------------------
     321.80      283.66        154.05         68.26
```

SCI-GROW output

```
  RUN No.   1 FOR oxamyl              INPUT VALUES
  --------------------------------------------------------------------
   APPL (#/AC)  APPL.  URATE    SOIL    SOIL  AEROBIC
   RATE          NO. (#/AC/YR)  KOC   METABOLISM (DAYS)
  --------------------------------------------------------------------
     2.000      6      12.000        9.0       16.0

  GROUND-WATER SCREENING CONCENTRATIONS IN PPB
  --------------------------------------------------------
                   4.478186
  --------------------------------------------------------
 A=    11.000  B=    14.000  C=     1.041  D=     1.146  RILP=     2.972
 F=     -.428  G=      .373  URATE=    12.000  GWSC=        4.478186
```

Appendix D: Details of Supporting Ecological Toxicity Studies

Ecological toxicity studies required by the Agency for the registration/ re-registration of a pesticide, and the rationale behind these requirements, are listed in 40 CFR 158. The following studies submitted by the registrant were used to develop an ecological toxicity assessment for oxamyl.

Acute, Subacute Dietary, and Chronic Toxicity to Birds

Table D-1: Avian Acute Oral Toxicity Study Results for Oxamyl

Species	*% ai*	*LD_{50} (mg/kg)*	*Toxicity Category*	*MRID No. Author/Year*	*Study Classification*[1]
			Technical Grade		
Mallard duck *(Anas platyrhynchos)*	97.1	3.16	Very highly toxic	00094660; Dudeck, 1981	Core
			Formulated Product		
Bobwhite quail (*Colinus virginianus*)	24	39.2 [2]	Very highly toxic	00113385; Fink, 1977	Supplemental
Mallard duck (*Anas platyrhynchos*)	24	10.75 [2]	Very highly toxic	00113384; Fink, 1977	Supplemental

[1] Core (study satisfies guideline). Supplemental (study is scientifically sound, but does not satisfy guideline)
[2] LD_{50} has not been adjusted for % active ingredient

Table D-2: Avian Subacute Dietary Toxicity Studies for Oxamyl

Species	*% ai*	*5-da LC_{50} (mg/kg)*[1]	*Toxicity Category*	*MRID No. Author/Year*	*Study Classification*
			Technical Grade		
Bobwhite quail *(Colinus virginianus)*	97.1	340	Highly toxic	40606511; Grimes and Jaber, 1988	Core
Mallard duck *(Anas platyrhynchos)*	97.1	766	Moderately toxic	40606512; Grimes and Jaber, 1988	Core
			Formulated Product		
Bobwhite quail *(Colinus virginianus)*	24	225 [2]	Highly toxic	00114398; Fink, 1977	Supplemental
Mallard duck *(Anas platyrhynchos)*	24	5025 [2]	Practically nontoxic	00040600; Fink, 1977	Supplemental
Mallard duck *(Anas platyrhynchos)*	24	1536 [2]	Moderately toxic	00113408; Fink, 1977	Supplemental

[1] Test organisms observed an additional three days while on untreated feed.
[2] Not adjusted for percent ai.

Table D-3: Avian Reproduction Effects From Oxamyl

Species/ Study Duration	*% ai*	*NOAEC/LOAEC (mg/kg)*	*LOAEC Endpoints*	*MRID No. Author/Year*	*Study Classification*
Mallard duck *(Anas platyrhynchos)*	97.1	10 / 50	Egg production and egg fertility	00116609; Roberts et al, 1982	Core
Bobwhite quail *(Colinus virginianus)*	97.1	50 / Not obtained	N/A	00116610; Roberts et al, 1982	Supplemental

Acute and Chronic Toxicity to Small Mammals

Table D-4: Acute and Chronic Mammalian Toxicity Studies for Oxamyl.

Species/ Study Duration	*% ai*	*Test Type*	*Toxicity Value (mg/kg)*	*Affected Endpoints*	*MRID No.*
Laboratory rat *(Rattus norvegicus)*	97.1	Acute oral	LD_{50}=2.5 (Female); 3.1 (Male)	Death	00245474
Laboratory rat *(Rattus norvegicus)*	97.1	Reproduction	NOAEL=25; LOAEL = 75	Decr. body wt. during lactation	41660801
Laboratory rat *(Rattus norvegicus)*	DMCF metabolite	Reproduction	NOAEL=150; LOAEL =450	Decr. body wt. of weanlings	001718

Toxicity to Beneficial Insects

Table D-5: Nontarget Insect Acute Contact Toxicity Studies for Oxamyl.

Species	*% ai*	*LD_{50} (µg/bee)*	*Toxicity Category*	*MRID No. Author/Year*	*Study Classification*
Honey bee *(Apis mellifera)*	Tech.	10.32	Moderate	00036935; Atkins et al, 1975	Core
Honey bee *(Apis mellifera)*	Tech.	0.31	Highly toxic	05001991; Stevenson, 1978	Core

The results indicate that oxamyl is moderately to highly toxic to bees on an acute contact basis. The guideline (141-1) is fulfilled (MRID's 00036935, 05001991).

A honey bee toxicity of residues on foliage study using the typical end-use product is required for oxamyl because its use will result in honey bee exposure and the acute contact honey bee LD50 is less than 0.11 *ug*/bee. Results of this test show that residues of Vydate L, appied at 1.0 lb ai/acre, may remain toxic to bees for as long as 6 days after treatment. The guideline (141-2) is fulfilled (MRID 409943-01).

Two studies (MRIDs 449381-01 and 449381-02) were submitted to evaluate the effects of Oxamyl 10L on the predatory mite (*Typhlodromus pyri*) and the aphid parasitoid wasp (*Aphidius rhopalosiphi*), both being beneficial insects. Both studies are classified as supplemental as neither were required, neither were guideline studies and the 10L formulation is not registered in the U.S.A. Nevertheless, both studies reported 48 hour LC50s of 0.03g ai ha^{-1} (for the wasp) and 0.6g ai ha-1 (for the mite). Neither study resulted in effects on fecundity at the reported exposure rates when compared to controls.

Acute and Chronic Toxicity to Freshwater Fish

Table D-6: Freshwater Fish Acute Toxicity Studies for Oxamyl.

Species	*% ai*	*96-hour LC_{50} (mg/l)*	*Toxicity Category*	*MRID/Acc No.*	*Study Classification*
			Technical Grade		
Rainbow Trout *(Onchoryhncus mykiss)*	90.0	4.7	Moderately toxic	66916	Core
	97.0	4.2	Moderately toxic	400980-01	Core
Bluegill sunfish *(Lepomis macrochirus)*	97.0	10.0	Moderately toxic	400980-01	Core
	90.0	5.6	Moderately toxic	66914	Core
Channel Catfish (*Ictalurus punctatus*)	97.0	17.5	Slightly toxic	400980-01	Core
Goldfish (*Carassius auratus*)	90.0	27.5	Slightly toxic	66915	Supplemental
			Formulated Product		
Rainbow trout *(Oncorhynchus mykiss)*	24.0	3.7	Moderately toxic	400980-01	Core
	24.0	12.4	Slightly toxic	099754	Supplemental
Bluegill sunfish *(Lepomis macrochirus)*	24.0	6.7	Moderately toxic	400980-01	Supplemental
	24.0	6.13	Moderately toxic	0040505	Supplemental
Channel Catfish (*Ictalurus punctatus*)	24.0	13.5	Slightly toxic	400980-01	Supplemental

Table D-7: Freshwater Fish Early Life-Stage Toxicity Under Flow-through Conditions

Species	*% ai*	*NOAEC/LOAEC (mg/l)*	*Endpoints Affected*	*MRID No.*	*Study Classification*
Rainbow trout *(Oncorhynchus mykiss)*	97	0.77/1.5	Embryo hatch and larval swim-up	409011-01	Core
Fathead Minnow *(Pimephales promelus)*	97	>0.5/<1.0	Larval survival	94663	Core

Acute and Chronic Toxicity to Freshwater Invertebrates

Table D-8: Freshwater Invertebrate Acute Toxicity Studies for Oxamyl.

Species	*% ai*	*48-hr LC_{50}/ EC_{50} (mg/l)*	*Toxicity Category*	*MRID/Acc No.*	*Study Classification*
		Technical Grade			
Waterflea *(Daphnia magna)*	97.0	0.42	Highly toxic	400980-01	Core
	97.1	5.7	Moderately toxic	94664	Core
Midge *(Chironomus plumosus)*	97.0	0.18	Highly toxic	400980-01	Core
		Formulated Product			
Waterflea *(Daphnia magna)*	24.0	1.95	Moderately toxic	157954	Core
	24.0	0.49	Highly toxic	231425	Core
	24.0	5.6	Moderately toxic	400980-01	Supplemental
Midge *(Chironomus plumosus)*	24.0	0.17	Highly toxic	400980-01	supplemental

A life-cycle test conducted with the active ingredient (97% ai) on waterflea (*Daphnia magna*) found a 21-day No Observed Adverse Effect Concentration (NOAEC) of 1.0 mg/l and a Lowest Observed Adverse Effect Concentration LOAEC) of 4.2 mg/l. Increased mortality was the affected endpoint in the study. The guideline (72-4) is fulfilled (MRID 248463).

Acute and Chronic Toxicity to Estuarine and Marine Fish

Table D-9: Marine fish Acute Toxicity Studies for Oxamyl.

Species	*% ai*	*96-hour LC_{50}/EC_{50} (mg/l)*	*Toxicity Category*	*MRID/Acc No.*	*Study Classification*
sheepshead minnow *(Cyprinodon variegatus)*	tech	2.6	Moderately toxic	421034-01 409011-01	Core

Acute toxicity testing on the preferred species, sheepshead minnow *(Cyprinodon variegatus)*, resulted in a 96-hour LC_{50} of 2.6 mg/l, which is considered to be moderately toxic on an acute basis. No data have been submitted for estuarine/marine fish early life-stage or life-cycle toxicity testing (MRID 421034-01/409011-01).

Acute and Chronic Toxicity for Estuarine and Marine Invertebrates

Table D-10: Marine Invertebrate Acute Toxicity Studies for Oxamyl.

Species	*% ai*	*96-hour LC_{50}/EC_{50} (mg/l)*	*Toxicity Category*	*MRID/Acc No.*	*Study Classification*
Eastern oyster *(Crassostrea virginica)*	24	0.40 (48hr EC_{50})	highly toxic	113414	Core
Grass shrimp *(Palaemonetes vulgaris)*	24	2.9	Moderately toxic	113412	Core
Fiddler crab *(Uce pugilator)*	24	23.0	Slightly toxic	235326	Supplemental

No data have been submitted for estuarine/marine invertebrate life-cycle toxicity testing.

Toxicity to Plants: Currently, plant testing is not required for pesticides other than herbicides and fungicides except on a case-by-case basis (e.g., labeling bears phytotoxicity warnings, incident data or literature that demonstrates phytotoxicity). Plant testing is required for uses bearing plant growth regulating label claims. *Oxamyl has a residual period in plants of approximately 1 to 2 weeks. Plants take oxamyl up through both leaves and roots.

*Kidd, H. and James, D. R., Eds. The Agrochemicals Handbook, Third Edition. Royal Society of Chemistry Information Services, Cambridge, UK, 1991 (as updated). Pg. 3-11.

Calculating Terrestrial EECs for Oxamyl Residues on Soil

Below are formulae used to calculate the predicted maximum residues in milligrams of active ingredient per square foot (mg ai/ft^2 rounded to one decimal place) on oxamyl-laden soil based on current maximum single application rates. Standard values of 100 percent for broadcast, unincorporated; 15 percent for banded, incorporated; and 1 percent for in-furrow, incorporated applications are used to indicate the amount of oxamyl remaining on the soil surface.[2]

Tomato

For 60-inch row spacing and 2" bandwidth, sidedress (**un-incorporated**): (All equations shown)

0.0002295 lb ai/1,000 ft of row = 2 lb ai/acre/ [43,560 sq ft/acre/(60 in row spacing X 1 ft/12 in)]
0.167 Bandwidth (ft) = 2 in x 1 ft/12 in
17.38 ai (mg)/sq ft = 453,590 mg/lb x [0.0002295 lb ai/1,000 ft of row /(1,000 ft x 0.167 bandwidth (ft))]
17.38 Exposed ai (mg)/sq ft = 17.38 ai (mg)/sq ft x 1 (100 percent unincorporated)

Duck: LD_{50}s/sq ft = 17.38 Exposed ai (mg)/sq ft /3.2 LD_{50} x 1.2 weight of bird (kgs) = **5.4**
Rat: LD_{50}s/sq ft = 17.38 Exposed ai (mg)/sq ft /2.5 LD_{50} x 0.3 weight of bird (kgs) = **23.2**

Potato

For 36-inch row spacing and 3" bandwidth, **(incorporated)**: (All equations shown)

0.0002754 lb ai/1,000 ft of row = 4 lb ai/acre/ [43,560 sq ft/acre/(36 in row spacing X 1 ft/12 in)]
0.25 Bandwidth (ft) = 3 in x 1 ft/12 in
31.21 ai (mg)/sq ft = 453,590 mg/lb x [0.0002754 lb ai/1,000 ft of row /(1,000 ft x 0.25 bandwidth (ft))]
0.31 Exposed ai (mg)/sq ft = 31.21 ai (mg)/sq ft x .01 (1 percent unincorporated)

Duck: LD_{50}s/sq ft = 0.31 Exposed ai (mg)/sq ft /3.2 LD_{50} x 1.2 weight of bird (kgs) = **0.1**
Rat: LD_{50}s/sq ft = 0.31 Exposed ai (mg)/sq ft /2.5 LD_{50} x 0.3 weight of bird (kgs) = **0.4**

Carrot

For 12-inch row spacing and 1" bandwidth, (**incorporated**): (All equations shown)

0.0001836 lb ai/1,000 ft of row = 8 lb ai/acre/ [43,560 sq ft/acre/(12 in row spacing X 1 ft/12 in)]
0.08 Bandwidth (ft) = 1 in x 1 ft/12 in
6.6 ai (mg)/sq ft = 453,590 mg/lb x [0.0001836 lb ai/1,000 ft of row /(1,000 ft x 0.08 bandwidth (ft))]
0.07 Exposed ai (mg)/sq ft = 6.6 ai (mg)/sq ft x .01 (1 percent unincorporated)

Duck: LD_{50}s/sq ft = 0.07 Exposed ai (mg)/sq ft /3.2 LD_{50} x 1.2 weight of bird (kgs) = **0.02**
Rat: LD_{50}s/sq ft = 0.07 Exposed ai (mg)/sq ft /2.5 LD_{50} x 0.3 weight of bird (kgs) = **0.09**

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2 "Comparative Analysis of Acute Avian Risk from Granular Pesticides," Office of Pesticide Programs, U.S. Environmental Protection Agency, Washington, D.C., March, 1992.

Appendix E: Risk Quotients and Levels of Concern

A means of integrating the results of exposure and ecotoxicity data is called the quotient method. For this method, risk quotients (RQs) are calculated by dividing exposure estimates by ecotoxicity values, both acute and chronic.

$$RQ = \text{EXPOSURE/TOXICITY}$$

RQs are then compared to OPP's levels of concern (LOCs). These LOCs are criteria used by OPP to indicate potential risk to nontarget organisms and the need to consider regulatory action. The criteria indicate that a pesticide used as directed has the potential to cause adverse effects on nontarget organisms. LOCs currently address the following risk presumption categories:

(1) **acute high** - potential for acute risk is high, regulatory action may be warranted in addition to restricted use classification
(2) **acute restricted use** - the potential for acute risk is high, but this may be mitigated through restricted use classification
(3) **acute endangered species** - the potential for acute risk to endangered species is high, regulatory action may be warranted, and
(4) **chronic risk** - the potential for chronic risk is high, regulatory action may be warranted.

Currently, EFED does not assess chronic risk to plants, acute or chronic risks to nontarget insects, or chronic risk from granular/bait formulations to mammalian or avian species.

The ecotoxicity test values (i.e., measurement endpoints) used in the acute and chronic risk quotients are derived from the results of required studies. Examples of ecotoxicity values derived from the results of short-term laboratory studies that assess acute effects are:

(1) LC_{50} (fish and birds)
(2) LD_{50} (birds and mammals)
(3) EC_{50} (aquatic plants and aquatic invertebrates) and
(4) EC_{25} (terrestrial plants).

Examples of toxicity test effect levels derived from the results of long-term laboratory studies that assess chronic effects are:

(1) LOAEC (birds, fish, and aquatic invertebrates)
(2) NOAEC (birds, fish and aquatic invertebrates) and
(3) MATC (fish and aquatic invertebrates).

For birds, mammals and aquatic organisms, the NOAEC value is used as the ecotoxicity test value in assessing chronic effects. Other values may be used when justified.

Tables E-1 through E-3 show how the RQs are calculated for each representative group (birds, mammals, fish, aquatic invertebrates, plants) and provides the levels of concern used in the subsequent evaluations.

Table E-1: RQ Calculations, LOCs, and Risk Presumptions for Terrestrial Animals

Risk Presumption	*RQ*	*LOC*
	Birds	
Acute High Risk	EEC[1]/LC_{50} , LD_{50}/sq ft[2] or LD_{50}/day[3]	0.5
Acute Restricted Use	EEC/LC_{50} , LD_{50}/sq ft or LD_{50}/day (or LD_{50} < 50 mg/kg)	0.2
Acute Endangered Species	EEC/LC_{50} , LD_{50}/sq ft or LD50/day	0.1
Chronic Risk	EEC/NOAEC	1
	Wild Mammals	
Acute High Risk	EEC/LC_{50} , LD_{50}/sq ft or LD_{50}/day	0.5
Acute Restricted Use	EEC/LC_{50} , LD_{50}/sq ft or LD_{50}/day (or LD_{50} < 50 mg/kg)	0.2
Acute Endangered Species	EEC/LC_{50} , LD_{50}/sq ft or LD_{50}/day	0.1
Chronic Risk	EEC/NOAEC	1

[1] abbreviation for Estimated Environmental Concentration (ppm) on avian/mammalian food items

[2] $\frac{\text{mg/ft}^2}{\text{LD50 * wt. of bird}}$

[3] $\frac{\text{mg of toxicant consumed/day}}{\text{LD50 * wt. of bird}}$

Table E-2: RQ Calculations, LOCs, and Risk Presumptions for Aquatic Animals

Risk Presumption	*RQ*	*LOC*
Acute High Risk	EEC/(LC_{50} or EC_{50})	0.5
Acute Restricted Use	EEC/(LC_{50} or EC_{50})	0.1
Acute Endangered Species	EEC/(LC_{50} or EC_{50})	0.05
Chronic Risk	EEC/(NOAEC)	1

Table E-3: RQ Calculations, LOCs, and Risk Presumptions for Plants

Risk Presumption	*RQ*	*LOC*
	Terrestrial and Semi-Aquatic Plants	
Acute High Risk	EEC[1]/EC_{25}	1
Acute Endangered Species	EEC/EC_{05} or NOAEC	1
	Aquatic Plants	
Acute High Risk	EEC[2]/EC_{50}	1
Acute Endangered Species	EEC/EC_{05} or NOAEC	1

[1] EEC = lbs ai/A

[2] EEC = (ppb/ppm) in water

Appendix F: Status of Guideline Data Requirements

Ecological Effects Data Requirements for: **Oxamyl**

Guideline #	Data Requirement	Is Data Requirement Satisfied?	MRID/ ACC #'s	Study Classification
71-1	Avian Oral LD_{50}	yes	00094660	Core
71-2	Avian Dietary LC_{50}	yes	406065-11/12	Core
71-4	Avian Reproduction	yes	00116610	Core
72-1	Freshwater Fish LC_{50}	yes	400980-01	Core
72-2	Freshwater Invertebrate Acute LC_{50}	yes	400980-01	Core
72-3(a)	Estuarine/Marine Fish LC_{50}	yes	409011-01	Core
72-3(b)	Estuarine/Marine Mollusk EC_{50}	yes	113414	Core
72-3(c)	Estuarine/Marine Shrimp EC_{50}	yes	113412	Core
72-4(a)	Freshwater Fish Early Life-Stage	yes	409011-01	Core
72-4(b)	Aquatic Invertebrate Life-Cycle	yes	248463	Core
72-5	Freshwater Fish Full Life-Cycle	not required		
122-1(a)	Seed Germ./Seedling Emergence	No		
122-1(b)	Vegetative Vigor	No		
122-2	Aquatic Plant Growth	No		
123-1(a)	Seed Germ./Seedling Emergence	not required		
123-1(b)	Vegetative Vigor	not required		
123-2	Aquatic Plant Growth	not required		
144-1	Honey Bee Acute Contact LD_{50}	yes	05001991	Core
141-2	Honey Bee Residue on Foliage	yes	409943-01	Core